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GEOGRAPHY AND THE CIVIL SERVICES.*

By the Rt. Hon. Sir GEORGE TAUBMAN GOLDIE, K.C.M.G., F.R.S., D.C.L., LL.D., President R.G.S.

I SHALL not follow to-day the frequent practice at these annual meetings of summarizing the geographical history of the preceding twelve months, as I desire to concentrate your attention on one question of unusual importance, which has suddenly come into prominent notice since our last meeting. For the same reason, I shall be as brief as is consistent with an intelligible exposition of the case; for the urgency of a satisfactory solution of the question with which I propose to deal calls for public attention, and this would be distracted rather than aroused by burying the matter under a cloud of words or by allowing it to overflow into side issues.

The question is whether Geography shall be accorded a place alongside of other sciences amongst the subjects eligible by candidates for the examinations which admit to the Civil Services of this country and its dependencies. As some of you may not have noticed, or may have forgotten, how this question first came to the front, I will briefly recapitulate the main facts. For a good many years, the Foreign Office has stood in an exceptional position amongst the Civil Services of the Crown by including Geography amongst the subjects for the entrance examinations of candidates. The Foreign Office, indeed, went further by making a pass in this subject compulsory. I may say, in passing, that it is reasonable to attribute partly to this attitude of the Foreign Office the noticeable fact that, of late years, so many valuable additions to our geographical knowledge have been due to members of the

* Presidential address at the Anniversary Meeting, May 27, 1907.

diplomatic and (especially) the consular services; for Geography, with its unceasing contact with an immense range of allied sciences, has an ever-growing attraction for those who have once ventured to penetrate into its sphere. It was a reasonable matter of hope that, with the advance of education and the widening of public opinion, the enlightened example of the Foreign Office would be gradually followed by some of our other public departments. The most important of these is the Colonial Office, which administers or controls vast regions contiguous to the possessions of foreign powers, which has to initiate or supervise frequent treaties with these powers of immense future importance, and which habitually supports or rejects proposals by its local administrators for the development of their colonies or dependencies, without necessarily possessing any knowledge whatever of the economic conditions of the regions with which it is dealing. In the Indian Civil Service, the Board of Trade, and the Post Office, some elementary knowledge of geography amongst even their subordinate members would surely be of value. I am inclined to add to this list our Education Department itself, from which—not so very long ago—was despatched that often-quoted letter addressed to "Ottawa, Ontario, United States of America."

It may safely be asserted that in no country but our own would the policy have been followed of securing uniformity in the system of examinations for all the Public Services, not by levelling up to the standard of the Foreign Office, but by the opposite process of levelling down. That, however, has been our characteristically British method. After next month, Geography will cease to be a subject which candidates for the Foreign Office may even voluntarily select. It was inevitable that this remarkable decision should arouse a great deal of public attention, mainly, of course, on the ground of the maintenance of our national and imperial interests which come into touch with those of foreign nations in so many parts of the world.

This is, no doubt, a consideration worthy of much attention, but I am concerned to make it clear that the question is one of far wider importance than as merely affecting the efficiency of certain of our public services. That this fact has been so little recognized is, I think, due to a natural and even commendable repugnance on the part of cultured minds to admit that our educational systems, based nominally and to a large extent really on intrinsically sound educational principles—such as developing the thinking powers of the student, strengthening his judgment, quickening his perceptive faculties, and cultivating his memory—have also necessarily rested largely on what, for want of a better phrase, I must describe as financial considerations. These fall into two divisions. The first of them affects directly only the universities, but it affects indirectly the educational systems of all the non-State-aided schools in this country, as these for various reasons base their systems entirely on those adopted by the universities. It is

a serious misfortune that but few of the latter have been in a position to set apart sufficient funds for the endowment of a Chair in Geography or a School of Geography. Yet I do not know a single instance of a university in the United Kingdom which is indifferent on this question of geographical education. So far as I can gather—and I have taken considerable trouble to ascertain the general trend of feeling—nothing but the want of money prevents any of the universities from following the examples of Oxford, Cambridge and London. But in most cases the too scanty funds are already appropriated to older established branches of study which no thinking man would wish to see starved. Unfortunately, the Royal Geographical Society has no extensive resources of its own with which to come to the assistance in this matter of the universities generally. It has for years shared in the maintenance of the Schools of Geography of Oxford and Cambridge; but it would not be justified in advancing much further in this direction, in view of the heavy and urgent calls made upon its resources in entirely different directions. If, however, amongst its Fellows, or its sympathizers, there are any who are able and disposed to aid the advance of human knowledge by endowment, I do not think that they could better serve their purpose than by contributing to the founding of a Chair of Geography at any one of the universities as yet unprovided with a Geography School.

The other division of financial considerations to which I alluded just now is of a less simple nature, but it is not less effective in blocking the progress of geographical education and the introduction of this subject into the list of those eligible by candidates for the public services. To avoid misapprehension on this point, let me premise that I am not dealing at present with the educational systems of our State- or rate-aided schools which are not dependent on the favour of parents nor subject to competition with other schools. It will suffice to confine our attention for the moment to private schools, public schools, and, to some extent, universities, that is to say, to institutions where the sons of the leisured classes, or the well-to-do classes, are brought up, and from which strata our educational ideas and systems have invariably filtered down to the less-favoured classes which are waging a daily struggle for bare existence. With rare exceptions, every educational institution, not supported by public funds, has to some degree—though a varying degree—to strike a tacit bargain with the parents of its students; the parents paying the money on which the prosperity or, most frequently, the existence of the institution depends, and requiring in return, in the vast majority of cases, that their boys shall receive such instruction as shall best enable them to compete on equal terms with their fellow-students. The proprietors of private schools, the governing bodies of public schools, and even, though to a lesser extent, the universities themselves, cannot therefore afford to give the same prominence to a subject which carries no marks in the civil and military

examinations that they give to subjects which carry such marks. On the other hand, the Civil Service Commissioners naturally hesitate to demand proficiency in a subject which holds only a secondary position, or sometimes no position at all, in the educational institutions of the country; and the question thus moves in a vicious circle.

I do not, of course, imagine that all the sons of the well-to-do classes of this country compete in examinations controlled by the Civil Service Commissioners; but the proportion of them so competing is sufficiently large to affect very seriously the standing in the whole educational sphere of any subject, according as it is or is not a means of gaining marks in the civil and military examinations; and it may, I think, be confidently asserted that if geography received the recognition which we desire, it would very shortly take its place in Great Britain, as it has long since done in the United States, Germany, and other countries, as one of the fundamental and indispensable elements in the education of childhood and youth. That this has not been the case up to now is probably due to the unintelligent and unmethodical manner in which the subject was taught until some twenty years ago, with the result that the majority of those who are to-day in a position to speak with authority, retain an entirely false impression of its scope and objects. Certainly, during my own school life, the hour in the week devoted to geography was universally anticipated with strong aversion as a dreary exercise of the memory in acquiring names entirely divorced from the realities of life, so that one of the most human and interesting of all branches of knowledge, intimately connected as it is with the history of mankind, with our present occupations and with our future development, was presented to us as an arid and flowerless waste. The new methods and conceptions of geography have been so frequently and fully placed before you by the most competent experts in our science that I must not attempt to summarize them in this brief address. I would recommend those who are not yet informed on this point to procure and study the questions in the examination papers of the University of Oxford. They will gather from them an idea of the true scope and value of the science, and they will probably find opening out before them new and unexpected lines of thought which will add materially to the interests of their own lives. It is, indeed, to the University of Oxford, supported, as I cannot doubt that it will be, by the Universities of Cambridge, London, Edinburgh, and other great centres of education, that geographers must look for a satisfactory solution of this important question; for, so far as can be gathered from correspondence on the subject which appeared in the columns of the *Times* some months ago, the Civil Service Commissioners are willing to consider the admission of geography as one of the voluntary subjects for examinations, provided the great universities will give a lead. In taking such a step, both the universities and the commissioners will

have behind them an immense pressure of public opinion, owing to the sudden awakening both of interest in the empire as a whole, and of recognition of our widespread ignorance of its geographical conditions. The mass of cheap and, on the whole, useful literature that has recently been published on this subject, the new leagues that have been formed with the object of disseminating widely every kind of information on the features and potentialities of the various provinces of the empire, the important public meetings that have recently been held for the same purpose, and even such indications as the issue and ready sale of several new atlases containing far more detailed ecological and other information than had previously been shown—all combine to support the conviction that the educated classes of this country are awakening to the necessity of more thorough acquaintance with the various branches of our science. It is not to be denied that this new public feeling is to-day directed mainly towards knowledge of the empire. Only those who have travelled widely can fully realize the disadvantage under which British enterprise of every kind now lies, as compared with German and American enterprise, in maintaining and increasing its hold in foreign lands; but we may rest assured that if geographical interest and modes of thought are developed and established amongst us in regard to our widely scattered empire, we shall not fail to extend that interest and these modes of thought to the rest of the globe.

It may be thought by some of you that I have dealt with this subject on a too material or, at any rate, a too narrow basis; that I have dwelt exclusively on the disadvantages to our country of not emerging, as other nations have done, from geographical twilight into the brightness of knowledge; that I have said nothing of the highest of all pleasures, the love of science for its own sake. My justification is that the problem of the moment is how to diffuse over an entire nation an interest in geography, no matter on what grounds; that with every increase in the number of geographical students there will be found an increasing number of truly scientific geographers. The love of one's country and the desire for material prosperity are powerful human motives that no practical philosopher can afford to despise; while the rivalry between nations in extending the bounds of knowledge deserves his warmest commendation. Great Britain has exceptional duties to humanity in this direction. With her unrivalled history of exploration, with her predominance on the ocean, both as regards her navy and her mercantile marine, with her immense and widely scattered colonies and dependencies, with her great wealth and free institutions, she is the trustee of many talents, which she must not bury in the ground; and instead of lagging behind as she has, for many years, been content to do, in bringing up her children with some knowledge of the world they live on, it is her duty, as it will be her interest, to take her rightful place in the van of geographical science.

INLAND WATERWAYS.*

By GEORGE G. CHISHOLM.

WITH the exception, perhaps, of the subject of national characteristics, there is probably no subject on which it is easier and more tempting to generalize rashly than that of transport. And yet the subject is extremely complex. A very great variety of conditions have to be taken into account in determining what is really the most advantageous mode of carriage for any class of goods. In the present paper it is my duty to bring into relief the considerations of a geographical character that affect the problem. But that does not imply that other than geographical considerations are to be left out of account. In no geographical investigation whatever is it possible to proceed without any regard to considerations which must be deemed non-geographical. Even in the surveying of a country for mapping some non-geographical facts are always tacitly, if not expressly, assumed as determining the selection of the superficial features that are to be laid down. Non-geographical considerations are still more obvious in determining the degree of importance belonging to certain facts of local distribution. It is solely, for example, on non-geographical grounds that a high degree of prominence must always be given in geography to the study of climate. The nature of the non-geographical considerations that have to be borne in mind in special investigations varies with the nature of the subject. The subject of the distribution of plants cannot be handled without regard to facts which belong to the sphere of the botanist, that of animal distribution without the knowledge that belongs to the zoologist.

In considering, therefore, the subject of this evening, even from a geographical point of view, it is necessary to begin by pointing out the more important facts of a non-geographical character that have to be taken into account in dealing with the geography of the subject, that is to say, in showing or endeavouring to show how far the utility of inland waterways is affected by local conditions and place relations. It is facts that cannot be called geographical that must determine what local conditions and what place relations are of most importance with reference to the question.

Now, it is fortunate that we are in a position to recognize one important circumstance that greatly simplifies the discussion. In this country, and in all advanced commercial countries, the question is always discussed, at least avowedly, as one of economy. It is not so everywhere, nor has it always been so in our own country. In the part of the Yangtse river where the rapids occur, the substitution of river-steamers or a railway for native junks is resisted by many Chinese on the ground that the numerous Chinese trackers who get a meagre

* Read at the Royal Geographical Society, February 25, 1907.

living by doing some of the hardest work in which human beings can engage would thereby be deprived of that living. I think I remember to have read that a similar objection to new means of transport caused the boatmen of Loch Lomond to break up the first steamboat that was launched on that lake. But we have now got beyond that stage. Such considerations are no longer taken into account in the discussion of rival modes of carriage. The question is one of economy and economy only.

But great difficulties remain. Economy in transport is not determined by the mere difference in the money cost of conveying goods, say, from one town to another. The economy to be considered with reference to transport is that of carrying goods from the place of origin to the place of consumption—the carriage of coal, for instance, from the mines to our hearths, or of wheat from the wheat-fields to our tables in the form of loaves, for the place where the loaf is to be eaten has an important influence in determining where the wheat is to be ground into flour.

Those who think only of carriage from one point to another are much impressed with such figures as these. On an ordinary good waggon-road a single horse-power will draw about 3000 lbs. at the rate of 2 miles an hour, on a railway about 30,000 lbs. at the same rate, on water as much as 200,000 lbs. When it is considered, moreover, that the ratio of the paying load to the dead weight is higher in ships and boats than in road and railway waggons, the advantage in favour of waterways seems overwhelming. Yet these figures are far from settling the question. First, there is the consideration of time. In most cases a speed of 2 miles an hour is not to be thought of. Quickness of transport is becoming every day more important. It is obvious that with rapid means of transport a given amount of capital is more frequently turned over in any business, and manifestly, too, this must be a more important consideration the greater the value that is locked up in the goods carried. Now, by water transport, even under the most favourable conditions, it is nowadays more costly to develop a high speed than it is by land, and there are very few inland waterways that offer those favourable conditions. Still, speed is not equally important in all cases. The greater the bulk of the goods in proportion to their value, the heavier will be as a rule the relative cost of carriage, the more important, therefore, a money saving in transport charges, and the less urgency to that extent for economizing merely in time.

But, further, even in considering different methods of transport between two points on which a waterway is available, it must be borne in mind that great economies in transport are secured by carrying goods in great quantities. It is for this reason that British shippers keep building larger and larger numbers of large ships and increasing the size of those ships, and Americans keep building more and more powerful locomotives for the hauling of long trains composed of huge steel waggons built as light as possible in proportion to the load they carry.

On this ground the utility of a waterway must depend very greatly on its capacity.

Again, only a comparatively small quantity of goods can be conveyed direct by one means of transport from the point of origin to the place of consumption or utilization. They have mostly to be transferred from one vehicle to another. This necessarily involves cost. The cost varies greatly with the nature of the commodities handled, but in all cases it makes it important to avoid this handling as much as possible. In a report advocating a great scheme, which I shall have occasion to refer to again in this paper, it is stated that "a ton of coal is carried the thousand miles from Buffalo to Duluth for about the cost of shovelling it from the side walk into the cellar;" * and though I would not be understood to hint that when coal is handled on a large scale, the cost of handling approaches the cost of finally putting it in the cellar, still this statement is a significant reminder of the importance of this element in the cost of carriage. The advantage to Germany of being able to communicate by rail without break of bulk with all surrounding countries except Russia (where there is a different railway gauge) can be abundantly illustrated from the commercial statistics of that country. It was to secure this advantage that great railways were built across and partly through the Alps, and the numerous trains to be seen even in central Italy (how far south I cannot say from my own observation) containing waggons that have come, if we may judge from the inscriptions on them, both from Austria across the Brenner and from the Rhine valley through the St. Gothard, are a speaking illustration of the same thing. The St. Gothard tunnel had a very speedy effect in developing a trade, even in heavy iron goods, between Germany and Italy, and German coal has been carried into Italy as far as Milan, though whether that trade is still carried on, I am unable to say. Through the courtesy of the Intercontinental Railway Company and of Mr. Ernest de Rodakowski, author of 'The Channel Ferry,' an extremely interesting and instructive work written to advocate carrying on trade without break of bulk between this country and the continent by a method not open to the objections urged against the proposed Channel tunnel, I am able to illustrate this important point by some lantern slides which, I think, will speak largely for themselves.

The first shows how the trade in imported meat is carried on between Southampton and London. The meat, on being taken out of the importing ship, is transferred, not to railway trucks, but to lorries or road-waggons mounted on the trucks. Each truck is capable of carrying 10 tons, but as the pair of lorries has a weight of between 3 and 4 tons, it is clear that there must thus be a considerable addition to the dead weight hauled, even though the trucks are reduced to a simple

* This is no exaggeration. The average freight for hard coal from Buffalo to Duluth in 1904 was about 1*s*. 6*d*. per long ton; in 1905, about 1*s*. 10*d*.

platform mounted on wheels, and on the return journey to Southampton the whole train is dead weight, as no suitable freight for the carts can be found. Yet the mere saving in handling has caused this mode of transport to be carried on with satisfactory results to the company for about seventeen years.

My second illustration is one of a channel ferry-boat, such as was familiar to me in my boyhood in the earty sixties as plying between Granton and Burntisland under the name of "leviathans." The width of the crossing effected by those boats was only 5 miles, but since then the same method of transport has been adopted for crossings up to 96 miles (the widest being from Ludington to Milwaukee, on Lake Michigan). The present view shows the *Solano* on the passage from Oakland to San Francisco, a boat which carries on its four rail-tracks twenty-seven passenger cars or forty-two goods waggons of the ordinary large American type.

The third illustration shows the method by which the trucks are landed on the Warnemünde-Gjedser route between Germany and Denmark, opened on October 1, 1903, with reference to which I am able to give some particulars of direct significance regarding the subject now in hand. In the first place, I am informed that the waggon marked "Breslau" actually came from Breslau, a distance of some 350 miles from Warnemünde, 375 miles from Gjedser, and 480 miles from Copenhagen, for which it was not improbably destined. Now, if it was for Copenhagen, that was a journey on which an all-water route was available, first by means of a river accommodating boats of 400 tons burden to Stettin (305 miles), and then by sea-going vessels. Yet the rail route was preferred. On one occasion on which Mr. E. de Rodakowski accompanied the train, only six minutes elapsed between the arrival at Warnemünde and the departure of the steamer. The goods carried on that occasion were chiefly angle-iron, and I am informed by the London agent of the Intercontinental Railway Company that in the first nine months after the opening of this route 14,000 trucks and 60,000 passengers were conveyed by it; and since train-ferries were first opened for traffic in Denmark, many new industries have been developed to a considerable extent, and heavy machinery, glassware, etc., which in former years were imported into Norway, Sweden, and Denmark from England, are now being sent from Germany on the ferry-steamers.

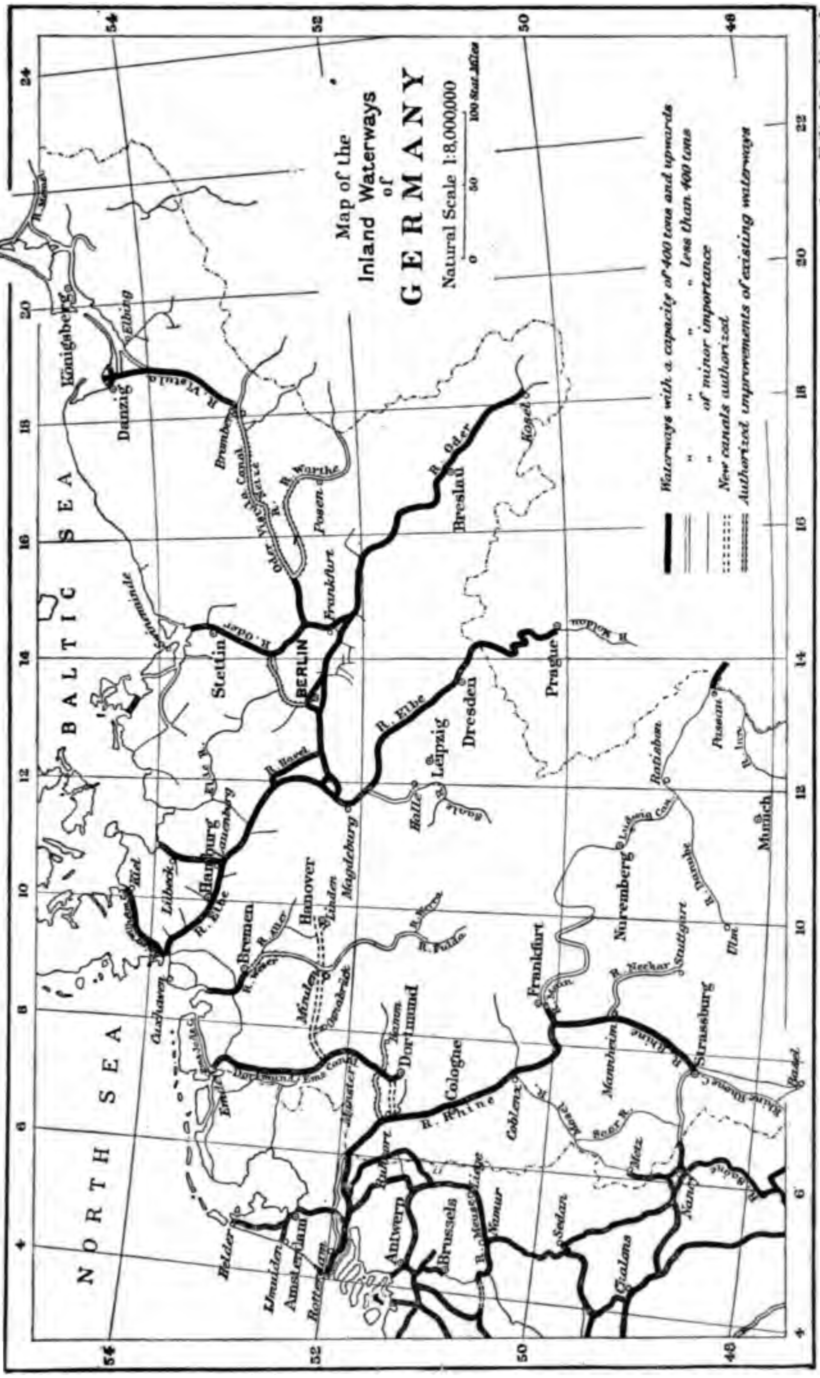
It is the balance of advantage determined by the two considerations mentioned, the economy of carriage on a large scale and that arising from the conveyance of goods as directly as possible from the place of origin to their destination, that determines in many cases the mode of transport. It is the advantage of transport on a large scale that causes from 40 to 70 per cent. of the pepper, 50 to 60 per cent. of the rubber, and large proportions of a great many other articles imported into this country to be re-exported as they arrive, that causes raw cotton

(Egyptian) to be always one of the leading exports from this country to the United States, and causes Belfast to export directly to foreign countries (or rather to one foreign country) a greater value of raw cotton than all British and Irish goods (including ships) put together. On the other hand, to illustrate the advantage of carrying goods as directly as possible from the place of origin to their destination, I may mention as a typical case that of a paper-mill which I remember to have existed near an east coast fishing-station, not important enough to be entered in the tables of British ports, which got all its supplies of China clay and esparto in small schooners entering the fishing-harbour after voyages lasting for weeks from Cornwall and Algeria respectively. The goods were thus brought within carting distance of a mill which could use the entire cargo. To take a case more immediately cognate to the subject under consideration, the same reason explains why so much English coal for domestic use is carried long distances by rail in comparatively small waggons. It is in that way, and probably in that way only, that convenient lots of the different qualities of coal required can be brought direct from the mines within easy carting distance of everybody's coal-cellar.

Now let us apply these general considerations on the subject of transport to inland waterways and the geographical conditions affecting their utility.

It will now be manifest that inland waterways are likely to be most effective in securing traffic—

1. The greater their capacity.
2. The greater the distance for which they permit of that economy in transport which is due to easier haulage or propulsion.
3. The more direct they are between any two points between which there is a competing means of transport.
4. The more favourable they are to rapid haulage or propulsion, a condition which, for the sake of clearness, it is well to discriminate, even though the advantage under this head is almost inevitably associated with high capacity.
5. The freer they are from such differences in level as necessitate the use of locks or other lifting and lowering contrivances, this being important, not merely in consequence of the loss of time in locking or otherwise changing the level, but in consequence of the additional expense, which varies with circumstances, being in many cases enhanced by the necessity of supplying locking water artificially, or by the impracticability of making locks of large capacity.
6. The smaller the impediments to navigation due to rapidity of current, or the occurrence of low or excessively high water, or ice.
7. The greater the amount of commodities, at once heavy and bulky in proportion to their value, procurable at some point or points on or near the waterway and consumed at other points similarly situated.



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8. The less the expense involved in the handling of commodities, including any expenses arising from damage or the risk of damage to the commodities. All kinds of coal suffer more or less in the severe handling involved in the use of waterways, but the softer kinds of course suffer most. While there is an enormous trade in coal on the great lakes of North America, coke, it is said, will not bear this mode of transport at all on account of the damage involved. Earthenware and glass may be conveyed undamaged in spite of the rough handlings to which they are exposed in water-transport, but the extra care required in packing adds to the expense, and even then the risk adds to the insurance.

9. The smaller the opportunity there is for railway or other competition. Railway competition is particularly formidable, not only because "the hard smooth road" (to adopt the description which Prof. Jevons applied to a railway) allows of far quicker transport than can be effected by any other means, but also because railways with their numerous interramifications offer the possibility of transport without break of bulk to a much greater extent than any system of inland waterways can approach.

If time permitted, illustrations might be given of the special importance of several of these factors in promoting the use of inland waterways; but time does not permit, and I will only say that it seems to me, from the examination I have given to the subject, that if any one of the nine can be singled out as the most decisive in furthering inland water traffic, it is the seventh—the existence of great quantities of bulky produce to be taken up and delivered at individual points on the same or a connected waterway. And yet, singularly enough, by far the most important article of commerce on the most magnificent system of inland waterways in the world is one of great value and small bulk; I refer to the rubber trade of the Amazon, which, it may be remarked, is a water trade solely because there is too little opportunity in that region for trade in bulkier commodities to justify the introduction of railway competition.

In order to realize the possibilities of inland water-traffic it will be well to examine in the light of the foregoing considerations what has actually been done under some specially favourable conditions. For this purpose I am able, through the courtesy of Messrs. Longmans, Green & Co., to show a map of the German waterways,* which to a large extent speaks for itself. It may be added that the improvements sanctioned by the Act of April 1, 1905, are intended to provide waterways on all the sections indicated west of the Oder for barges of 600 tons, on those east of the Oder for barges of 400 tons.

Of all the waterways shown on this map there is probably none

* With regard to the French and Belgian waterways shown in this map, it should be stated that those drawn in thick lines are those with a minimum depth of 2 metres, and that not all of these are navigated by barges of as much as 400 tons.

more worthy of study than the Rhine. It has peculiar advantages under all the heads mentioned except the last, and there is something to be said on the last head also, that is, with regard to the nature of the competition it encounters. It is (1) capacious enough to be regularly ascended by fairly large sea-going steamers as high as Cologne, by smaller sea-going vessels as high as Remagen, about midway between Cologne and Coblenz, and occasionally as high as Oberlahnstein, on the left bank of the Lahn above Coblenz, where they go to load with mineral water. Since the improvements in the gorge at Bingen were completed in 1899, barges of more than 2000 tons have been known to reach Mannheim, and those of 800 tons can reach Strassburg. (2) The distance of Mannheim from Rotterdam by water is 351 miles. The river in a large part of this stretch is (3) remarkably free from windings. The river distance is only 41 miles, about 13 per cent., greater than that by rail. (4) Powerful steamers can be used for carriage or haulage. (5) There are no locks as high as Strassburg, the present limit of Rhine navigation. There is only one to Frankfurt-on-the-Main. (6) Below Strassburg the rapidity of the current of the Rhine offers no serious hindrance to navigation, except perhaps in the narrowest part of the channel at the gorge of Bingen, though it is everywhere sufficient to make a marked difference between the rate of up-stream and down stream navigation.* The geographical conditions also tend to reduce the interruptions to navigation, from irregularity of flow and from ice. The fact that the upper Rhine is partly glacier-fed and lake-regulated tends to limit the variations of high and low water, and the westerly situation of the river is against its freezing. According to an official publication, the navigation of this river "is, on the average, annually interrupted by high water for 8 days, by ice 17 days, by low water 17 days; in all, accordingly, 42 days." † (7) At the mouth of the Rhine is Rotterdam, a world-port, and accordingly a great collecting point for all kinds of commodities, bulky and other. On the banks of the river within Germany, up to and including Strassburg, there are ten communes with a population exceeding 50,000, five of these with

* Some details may be of interest. The average speed of a train of four barges, carrying in all about 4000 tons, is given at 3 to 3¾ miles up-stream and 9 to 11 miles down. When the necessary night-rests are allowed for, the voyage from Rotterdam to Mannheim is made in summer in from 8 to 9 days, in winter in from 10 to 11 days; that from Mannheim to Rotterdam, in either case, in about 5 days. Express goods steamers, stopping at intermediate stations, ascend from Rotterdam to Cologne (190 miles) in about 36 hours = 5·6 miles an hour, descend on the return voyage in about 19 hours = 9·3 miles an hour. On the rare occasions on which a long voyage is made without stoppages, a speed of 5·3 miles an hour may be attained between Cologne and Mannheim (161 miles), one of 13·7 miles an hour between Mannheim and Cologne. Nasse, in 'Die Schiffahrt der deutschen Ströme,' herausgegeben vom Verein für Socialpolitik (Leipzig, 1903), vol. 3, pp. 142-3.

† Jasmund, 'Die Arbeiten der Rheinstrom-Bauverwaltung von 1851 bis 1900,' p. 54; quoted by Nasse in the work just cited, vol. 3, p. 138.

one above 100,000, and to these may be added Frankfurt, all great consuming centres for imported grain at least. Further, the river actually divides, below the point to which sea-going steamers regularly ascend, the most productive coalfield on the mainland of Europe, and this fact creates a demand for enormous quantities of imported ores. (8) Among the commodities grain is one that notoriously can be handled with peculiar facility, and ores, too, are comparatively inexpensive to handle. The German coal is, indeed, more liable to be damaged by handling than the harder English coal, but this is not enough to invalidate the overwhelming advantages of the Rhine for a trade in coal of local origin.

These considerations may serve to prepare one for the figures given below, stating in thousands of metric tons (each 2205 lbs.) the total traffic on the Rhine at Emmerich, close to the Dutch frontier, at the adjacent harbours which serve as the outlets of the Ruhr coalfield, and at Mannheim, the terminal point of navigation for the larger craft.

Years.	Emmerich. Passed.		Ruhrort, Duisburg, and Hochfeld. Despatched.		Mannheim. Arrived up.
	Up.	Down.	Up.	Down.	
1895	4,880	3048	3446	2005	2436
1900	9,036	4130	6225	2370	3917
1903	10,028	7211	7154	4615	4251
1905	12,533	8119	6172	4125	3942

For the sake of comparison, it may be mentioned that the total quantity carried by the Manchester Ship Canal in 1905 was 4,250,000 tons.

And now let us see how those totals were made up. In 1905 the quantity of iron and other ores that passed up-stream at Emmerich was 5,352,000 tons; that of wheat and other grains of the temperate zone, 3,250,000 tons—in all 8,602,000 tons, leaving only 3,930,000 for all other commodities. Coal made up more than half the quantity that passed down. At Ruhrort, etc., coal made up 5,940,000 tons of the 6,172,000 tons sent up, and 3,492,000 out of the 4,125,000 tons sent down-stream. At Mannheim coal and grain together constituted nearly two-thirds of the total quantity received. The quantity of goods sent down-stream was comparatively small—660,000 tons, of which salt formed the most important item.

It is instructive, also, to note some of the commodities carried by water in smaller amount, and for that purpose I have selected four of the raw materials according to the classification of the official report on the inland waterways of Germany. In this case I have taken the Rhine and the Elbe together as the water-avenues to the chief manufacturing districts of the empire.

IMPORTS IN 1905 IN THOUSANDS OF METRIC TONS AND ONE DECIMAL OF A TON, WITH THE PERCENTAGE IMPORTED BY WATER OF THE TOTAL IMPORT.

	By Rhine and Elbe.	Total.	Percentage by water.
Raw cotton	73·9	402·9	18
" wool	40·4	165·1	24
Flax, hemp, and tow	70·2	140·6	50
Hides, skins, peltries, and leather	27·7	170·3	16

The only one of the four of which a large proportion is carried up by water is flax and hemp, and this may be accounted for in two ways—first, by the fact that this is much the least valuable of the four in proportion to its bulk; and, second, that the Elbe, by which the bulk of the import takes place, carries this commodity such a long distance on the way to the chief seats of manufacture in the eastern part of the kingdom of Saxony, the adjoining districts of Silesia, and the Austrian province of Bohemia.

The water-traffic of Berlin is also instructive. At last census the population of Berlin was upwards of two millions. The city is connected by waterways with the ports of Hamburg and Stettin, and up-stream with the river-port of Kosel, in the vicinity of the Prussian coalfield which ranks next in importance to that of the Ruhr basin. The Hamburg route has been navigable since 1894 for vessels of 600 tons burden, and on that route there are only three locks. The waterway up to Kosel has been available since 1897, in ordinary states of the river Oder, for barges of 400 tons. Owing to the comparatively small depth of the Finow canal, at present 4¼ feet, and the number of locks upon it, 17, the Stettin route is the least commodious of the three. In 1905 the total quantity of goods, including floated timber, delivered at Berlin by water, was 7,364,000 tons; and it is noteworthy that the total quantity despatched was less than one-eleventh of that, even though the shippers must obviously have every inducement to take return freight at the lowest possible rate. Of the goods delivered, those entered under two headings: (1) bricks, tiles, pipes, and other articles of baked clay, and (2) earth, loam, sand, limestone, and chalk, made up more than 57 per cent. of the total. These commodities are almost entirely of local origin. The third commodity in respect of percentage is coal, and the addition of it brings up the total proportion belonging to the first three commodities to nearly 73 per cent. The coal is partly Silesian, partly English, but in spite of the advantages afforded by the Oder, in 1901 only about 35 per cent. of the Upper Silesian coal sold in Berlin and its suburbs arrived by water.* In recent years, the

* 'Die Störungen im deutschen Wirtschaftsleben während der Jahre, 1900 ff.,' 2 ter Band, *Montan- und Eisenindustrie* (Leipzig: Duncker & Humblot, 1903), p. 157.

quantity of English coal reaching Berlin by Stettin and the Finow canal has been greater than that arriving by water from Silesia, in spite of the inferiority, and consequently greater expense, of the Finow route; one important difference in favour of the Stettin-Finow traffic being that the English coal necessarily arrives at the waterway in bulk, and has not to be brought down to it like the Silesian coal from the several mines. The coal brought to Berlin from Upper Silesia is chiefly for use in the large works alongside the waterways. For the reason already indicated, domestic coal comes mainly by rail. The same reason that keeps down the proportion of coal using the waterway from Silesia to Berlin, causes the great bulk of the Westphalian coal that comes to Hamburg to go by rail. Even the opening of the Dortmund-Ems canal, which was constructed expressly for the purpose of providing a water outlet for the coal of the Ruhr basin, has done little to develop that trade. The total quantity of goods carried down that waterway to the port at its mouth (Emden) in 1904 was just under 190,000 tons, of which 97,000 tons was coal; in 1905, 224,000 tons carried down, of which 68,000 tons was coal. Up-stream from Emden there passed, in 1905, 475,000 tons, of which 258,000 tons consisted of iron ores.

Those who advocate the improvement of existing waterways and the construction of new ones, very often lay great stress on their value as a means of carrying local agricultural produce and manufactured goods specially for export. It will, therefore, be worth while to consider what is achieved by the German waterways under these heads. For the consideration of the efficiency of waterways as carriers of agricultural produce, Germany affords no better subject of study than the great consuming centre of Berlin. Elaborate tables* drawn up in a work already quoted, written in the interest of the German waterways, enable us to make comparisons on this head. The raw agricultural products most largely carried by water to Berlin are the chief bread-grains of Germany, rye and wheat, and, on the average of the years 1896–9, about 69 per cent. of these were received by water, about 31 per cent. accordingly by rail. But nearly all this was foreign grain collected at the seaports. A different tale is told by the figures relating to potatoes. In 1899 the proportion conveyed to Berlin by water was less than 2 per cent. In fact, an examination of the data regarding the trade in agricultural products generally bears out the truth of the general statement made in the work just cited,† that "the raising of agricultural products always presupposes a relatively extensive area of production, and is thus a decentralized industry, on which account, in the great majority of cases, it is only the railways that come into consideration with reference to their transport."

* 'Die Schiffahrt der deutschen Ströme,' vol. 1, pp. 185 and 238–245.
† Vol. 1, p. 152.

Of manufactured articles carried by waterways, the only one of importance as regards quantity, except on the Elbe, on whose banks there are large centralized industries concerned in the refining of sugar and the manufacture of fertilizers, are iron and iron wares. Now, in 1905, of the raw and scrap iron conveyed to the seaports or across the German frontier, only about 25 per cent. was carried by water, 75 per cent. by rail, and all but a small fraction of the quantity carried by water went by the Rhine, that carried by the Dortmund-Ems canal being utterly insignificant. Of the iron and steel manufactures of all kinds similarly carried, the share of the waterways was about 40 per cent., that of the railways 60 per cent., and in this case again the share of the Rhine made up the great bulk (more than 95 per cent.) of the total water-borne traffic. That of the Dortmund-Ems canal was little more than 2 per cent.

So far we have considered only the really effective waterways of Germany, but some of the minor ones are also worthy of attention. For example, there is the celebrated Ludwig's canal, a waterway 5 feet deep, connecting, with the aid of other waterways, the Rhine and the Danube. What does it do? It carries on a trifling and dwindling amount of traffic, chiefly centred, as is natural, at Nuremberg, where, in 1905, the total quantity of goods received and despatched by it in both directions was much under 50,000 tons. At Kelheim this canal passed into the Danube 4637 tons of goods, chiefly timber; from the Danube towards the Main, 676 tons. Then there is the Ruhr, which flows through the great German coalfield to the Rhine, and can take barges of 165 tons—that is much larger than the great majority of English waterways. In this case it is worth while noting what it once did, as well as what it now does. In 1860 it carried in all 900,000 tons of goods, of which coal made up 868,000 tons. In 1905 it carried 1431 tons of stone down stream, and nothing up.

The result was due to railway competition, which comes under the ninth of the geographical considerations above enumerated as affecting the utility of waterways. And now it may be remembered that this is a subject on which, I have intimated, something remained to be said in connection with the traffic on the Rhine. That traffic is carried on against a good deal of railway competition. In the narrower part of the Rhine valley there is a double line of railway on either bank of the river, and there are more railways running in the same direction higher up. But the competition is not equal, I mean, not based solely on the merits of the two methods of transport. For, in the first place, the German state railways are admittedly not worked on the principle of offering the most effective opposition possible to the waterways; and, on the other hand, the states adjoining the Rhine have spent some £8,000,000 in bringing the navigation of the river to its present condition, and have handed over the river to the shippers free of toll. And

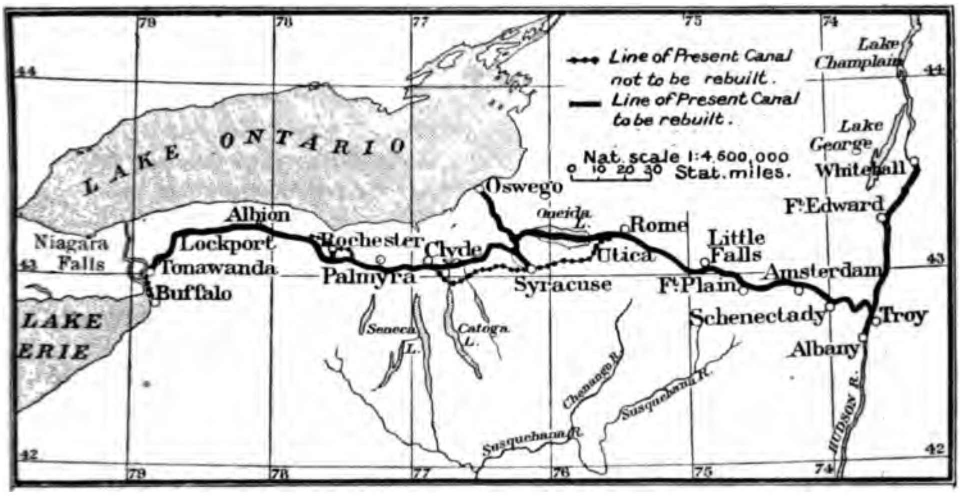
yet even under these conditions some of the shipping companies in a recent period had very bad times. In 1902 eight out of nineteen companies paid no dividend. In 1903 four paid none. Under the recent Act for the improvement of the waters it is declared that when those improvements are carried out, or rather when the Rhine-Weser canal or a section of it has been brought into operation, all those rivers on which the state has spent money in the interest of the navigation shall be subjected to such tolls as shall serve to pay a suitable rate of interest on the outlay and something towards the amortization of that outlay. This enactment has caused many of those who insist most stoutly on the advantages of water-transport, to cry out with dismay that the rivers will not be able to stand such a burden. "For the human soul," says George Eliot, "is hospitable, and will entertain conflicting sentiments and contradictory opinions with much impartiality."

Let us now turn to America. The experience of that part of the world is not without instruction for us, even though the conditions under which most of the inland water-traffic is there carried on are even more unlike those in our country than the conditions in Germany. The bulk of that traffic is the traffic of the great lakes, and so far as that is confined to the great lakes it corresponds, not to our inland water-traffic, but to our coasting trade. By far the greater proportion of it is so restricted. But the great lakes also form part of two waterways from the interior to the seaboard, one Canadian and the other belonging to the United States. The Canadian is of course that of the St. Lawrence, leading to Montreal, and has peculiar advantages for carrying on an export trade in grain. Since the completion, in 1899, of the improvements on the St. Lawrence there has been a minimum depth of 14 feet on the entire waterway. At the head of the route are the enormous grain—above all wheat—collecting points of Fort William in Canada and Duluth and Chicago in the United States. But as against these advantages it has to be remembered that the route is closed by ice for about five months or more every year. In spite of this drawback the waterway carries on an average much more than half the grain carried eastwards to Montreal. In the thirteen years, 1893 to 1905, the water-borne proportion varied from 83 to a little more than 47 per cent., this minimum having been the limit of a regular decline in the proportion of grain so carried from 1895 to 1901. By 1905 the proportion of water-borne grain had risen again to nearly 72 per cent., but in this we may probably see the effect of the abolition, in 1903, of tolls on all grain carried through both the Welland and the St. Lawrence canals, though a toll of 10 cents (say *5d.*) a ton is still levied on all grain that passes through the St. Lawrence canals only. The meaning of this discrimination obviously is that on the heavy long hauls the railway is able to offer very effective competition even with this advantageous waterway.

The success of this waterway has long ago inspired the Canadians

with the idea of taking advantage of the geographical conditions to create a more effective waterway, offering the recommendations both of a shorter route and greater depth. This project is what is known as the Ottawa and Georgian bay scheme. The promoters of this scheme urge that by deepening in places the river Ottawa, by utilizing Lake Nipissing and its outlet the French river leading to Lake Huron, and by constructing the necessary canal connections, a waterway running nearly due west from Montreal would be substituted for that which first ascends a long distance to the south-west and then turns northwards. In that way a saving of about 340 miles in the voyage to and from the higher lakes would be saved. Further, of the total length of 425 miles on this new route 307 miles would be made up of river and lake naviga-

NEW YORK STATE CANALS
Constructing under a Law of 1903.



tion needing no improvement to admit of its being navigated by vessels of 20-feet draught. A committee of the Dominion Parliament has recommended the carrying out of the scheme and the adoption of a depth of 22 feet for the whole route. One drawback, however, is unavoidable on this proposed route. In consequence of its northerly situation, there would be only a very short season after harvest in which it would be free from ice.

The United States waterway which continues to the seaboard the navigation of the great lakes is the Erie canal with the Hudson river. This has the advantage of being connected with a much more important seaport than the St. Lawrence route, but, on the other hand, is much inferior as a waterway. It has at present a depth of only 7 feet, and the maximum size of the barges which make use of it is only about

250 tons. In this case, accordingly, we find that the railways are able to compete with the waterway much more effectively than in Canada, even though the canal is maintained by the state entirely free from tolls. On this head, however, one instructive difference may be noted between the practice in Germany and that both of Canada and the United States. In these two countries the railways that compete with the waterways are all private undertakings, and do all they can to compete with their rivals in the most effective manner. The result is that of the total amount of grain carried to New York in 1905 about $93\frac{1}{2}$ per cent. was transported by rail as against some $6\frac{1}{2}$ per cent. by water. In recent years, the actual quantity of goods of all kinds carried by the Erie canal has greatly diminished—from a maximum of 4·6 million tons in 1880 to less than 2 millions in 1904. And this was mainly made up of local traffic. The amount carried by the canal to tide-water in that year was considerably less than one million tons. In 1880 all the canals of the state of New York carried rather more than 25 per cent. of the total traffic of the state, in 1904 less than 5 per cent. In order to restore, if possible, the efficiency of the waterways, the state is now spending about £21,000,000 in making a canal with branches with a depth of 12 feet, and capable of accommodating barges of 1000 tons, on the routes shown on the accompanying map.

Of the natural inland waterways of the United States, in addition to the great lakes, the Mississippi offers advantages for traffic of a kind to which not merely our own country, but the whole continent of Europe, can offer no parallel. Yet it is a very striking fact that even on these the ordinary steamer traffic has shown a great decline. No general statistics have, I believe, been collected since 1889, but the tenth and eleventh censuses of the United States allow of a comparison being made between the total traffic of 1880 and that of 1889, between which years the total amount of traffic carried on steamers in the Mississippi valley generally sank from 13·6 to 10·3, that on the Ohio from 9·2 to 3·8 millions of tons. In 1901 the total quantity of goods received at New Orleans from the interior was less than 5 per cent. of that received by all routes.* Still, from the Mississippi and Ohio we can obtain illustrations of the kind of traffic in which good waterways are even now successful. St. Louis is a great collecting point for grain. In 1903 more than 80 per cent. of the wheat and about 40 per cent. of the maize despatched thence for export to New Orleans went by river, and by this route rates for wheat on through bills of lading to Liverpool are only about two-thirds of those by way of New York.† Yet the facts, even of this trade, give us a hint also of what waterways fail to

* See the data in the Foreign Office Report, Annual Series, No. 2752, pp. 4, 5.

† Foreign Office Report, Annual Series, No. 3202, pp. 48, 49.

do, for only about one-seventh of the wheat and one-thirteenth of the maize exported in that year from New Orleans came to the port by water.

But the grain-trade of the Mississippi is largely, and the still greater coal-trade of the Ohio-Mississippi almost wholly, carried on in a peculiar manner possible only in very wide, though not necessarily very deep, rivers. It is by means of what are called tow-barges—that is, a number of barges firmly lashed together and pushed onwards by means of a stern-wheel steamer. The coal is all brought from the Ohio and its feeders, the Monongahela and the Great Kanawha, the first of which is one of the two headstreams of the Ohio which meet at Pittsburg, while the other joins the main stream in West Virginia. At Pittsburg tows of barges drawing 8 feet are made up, carrying from 10,000 to 15,000 tons of coal. They may have to wait for a sufficient depth of water before proceeding on their way to Cincinnati and Louisville. At Louisville two or three Pittsburg tows may be made into one, carrying from 35,000 to 40,000 tons. Even one of 70,000 tons is on record. One carrying 40,000 tons, Prof. Johnson tells us, is about 10 acres in extent.* At the same ratio, one of 70,000 tons would extend over 17½ acres—say 140 by 600 yards.

WATERWAYS OF ILLINOIS.
Natural Scale 1:7,000,000

It is boasted that this is the cheapest mode of inland carriage in the world, and yet even this traffic, which increased enormously between 1880 and 1889, would appear to be now declining in the aggregate, and is certainly not keeping pace with the enormous progress of the American coal trade generally. In 1889 the total amount of freight carried on the Ohio was officially returned at above 16,000,000 tons, of which tow-barge traffic made up considerably more than 12,000,000 tons. In a consular report for 1905, the total traffic of all kinds was estimated at 11,000,000 tons,† and the figures in the official returns for the coal trade

* Emory R. Johnson, 'Ocean and Inland Water Transportation' (London: Appleton, 1906), p. 364.

† For. Off. Rep., Ann. Ser., No. 3622, p. 35.

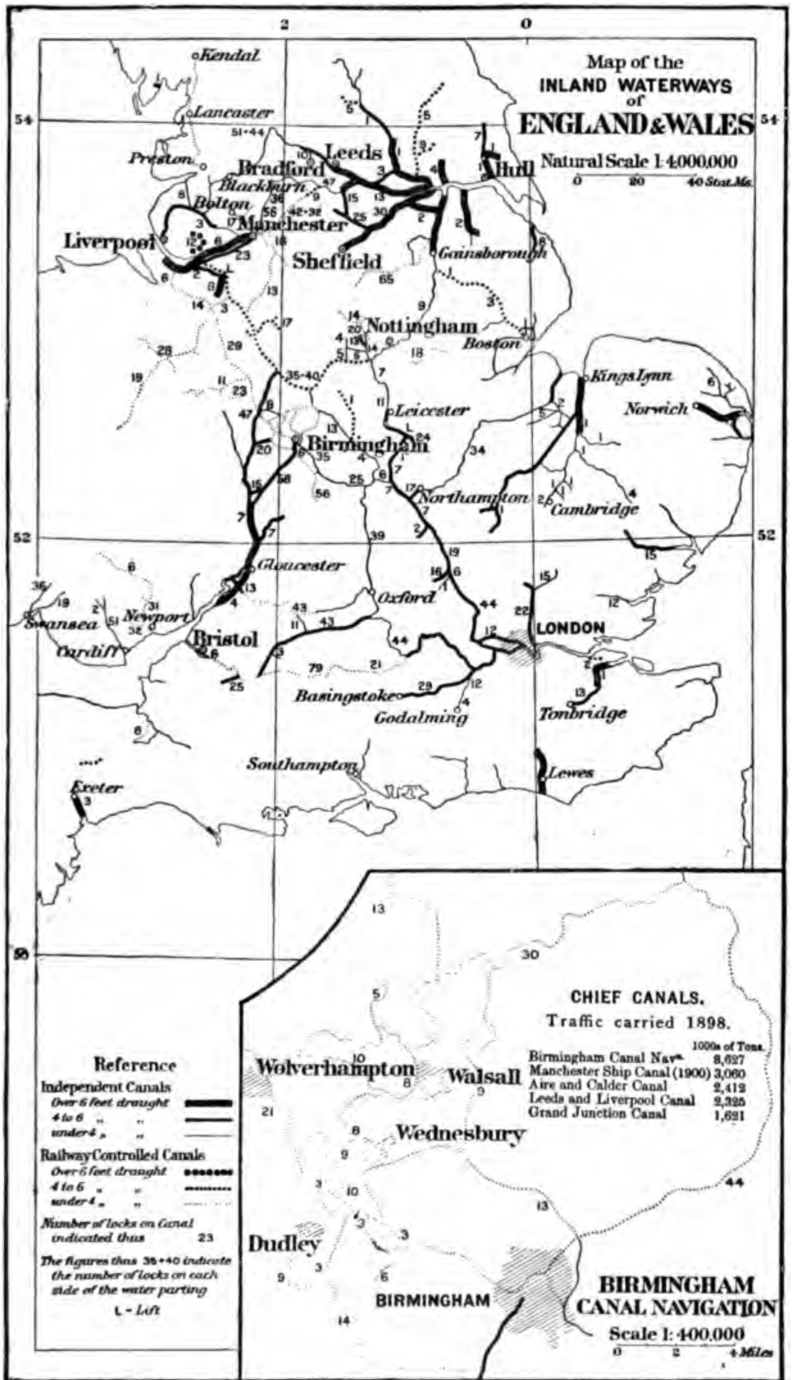
of the Great Kanawha in recent years are at least not progressive.* This, no doubt, is the cause of the demand made by those interested in the Ohio navigation for the improvement of that river by the Government of the United States, so as to afford a minimum depth of 9 feet at low water, a demand to which the Government has so far acceded as to obtain from Congress appropriations for a survey of the entire river for that purpose.

But a still greater project is now being agitated, one, namely, for the creation of an uninterrupted waterway of 14 feet in depth from Chicago to Orleans, so as to allow of loaded sea-going vessels passing from the one port to the other. An association, known as the Lakes-to-the-Gulf Deep Waterway Association, has been formed to carry out this scheme, and I am informed by its secretary that its total cost is estimated at about £14,500,000. Part of the proposed waterway would be formed by the Chicago Sanitary and Ship canal, connecting Chicago with the Des Plaines river, a canal with a minimum depth of 14 feet, begun in 1892, and now approaching completion. This canal the trustees of the Sanitary District of Chicago propose to hand over to the general government on condition that it completes the projected waterway; but when one considers that the 42 miles of this canal, when completed, will have cost about £11,500,000, the total estimate above given must surely be rather sanguine.

Such a project as this may at least serve to give an idea of the enthusiasm which inland waterways inspire in the minds of some people, but is not fitted to afford any guidance in the study of English waterways, and to these it is now time to devote attention. With reference to the special subject of this inquiry, namely, the influence of geographical conditions on rail and water transport, there are few countries, if any, in which the facts are more worthy of study than our own, seeing that in this country the two means of transport have been left to fight it out between themselves, with little interference on the part of the State. It has been the general rule in other countries, as in Germany and the United States, for the State to intervene on behalf of the waterways. In this country the only way in which the State can be said to prejudice the railways in the contest is in insisting, in the case of those canals which have become railway property, that the canals shall be maintained whether the railway can work them at a profit or not, and that the owning companies shall, at the demand of traders, quote rates subject to State regulation. I would not be understood to assert that this is undue interference on the part of the State. I merely mention it as at least a fact that should be recognized.

And here I may point out that the existence of railway-owned and

* See the Annual Report of the Chief of the Engineers of the War Department of the United States for 1905, vol. 6, part 2, pp. 1886–7.



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railway-controlled canals in this country introduces another geographical consideration, although only of a secondary order, by which I mean one not originally given or mainly determined by nature. Once established, however, the nature of the ownership may have geographical effects, and it is at least incumbent on us to inquire whether it has such or not. For that reason several canal maps have been drawn up in which the distinction of ownership or control is indicated, and one of these I am now able to show through the courtesy of Messrs. Longmans, Green, & Co. On this map, it should be noticed, the canals are distinguished, not as railway owned and independent, but as railway controlled and independent; for this makes an important difference, inasmuch as the Birmingham Canal Navigation belongs to an independent company. This, however, is a mere dividend-receiving company, the dividend being guaranteed by the London and North-Western Railway Co., which under an old agreement with the canal company controls the navigation.

This map also, following the well-known map of Mr. Lionel Wells, makes an attempt to distinguish the canals in respect of their capacity, and it will be noticed what a large proportion of them are small waterways of less than 4 feet in depth, many being not merely shallow but narrow and capable of being used only by what are known as narrow boats.*

Further, on this map an attempt has been made to indicate the effect of inequalities of level on inland navigation. In one respect the most satisfactory maps that have been published, so far as I know, giving indications under this head, are the large maps showing the waterways of England and Wales, of Ireland, and the Scottish midlands respectively, attached to the paper "On Waterways in Great Britain," read in November, 1905, by Mr. J. A. Saner, M.INST.C.E., to the Institution of Civil Engineers, of which the author was good enough to favour me with a copy. These maps show the waterways in relation to the physical features as indicated by contour-lines and intervening colouring. It is to be regretted, however, that they do not give the number of locks on the different waterways, which the scale of the maps would have made comparatively easy. Of the difficulties presented by English canals the best idea may perhaps be obtained from the sections published in Mr. E. A. Pratt's 'British Canals.' On the map now shown the number of the locks on different canals and waterways, or sometimes on sections of canals, has been given in figures, but the map is on rather a small scale for that to be done quite satisfactorily. It will, however, at least serve to keep us in mind of the

* The work affording the most complete information about English waterways under this and all other heads connected with their use, is Bradshaw's 'Canals and Navigable Rivers of England and Wales,' by H. R. de Salis (London, 1901).

fact that in this respect English waterways mostly suffer from great drawbacks.

It may be worth while to examine some of the more important canals separately with reference to this point. It will be noticed that there are three waterways connecting South Lancashire with the West Riding of Yorkshire, and, accordingly, crossing the Pennine chain; two of them independent canals, the third railway owned. The most important of these is the Leeds and Liverpool canal, the northernmost of the three, which, it will be observed, has fifty-one locks on the one side, forty-four on the other. It has, however, the easiest route of the three, going through the important feature which Mr. Mackinder has well called the Aire gap, at the height of only 477 feet above sea-level. The Rochdale canal, the next to the south, rises above 500 feet, and the Huddersfield canal reaches its summit, 656 feet, in the Stanedge tunnel 3 miles long. In the Harecastle tunnel, 4 miles north-west of Stoke, the Trent and Mersey canal attains a height of 460 feet. Birmingham is connected with the Thames by a waterway which starts at 380 feet above sea-level, sinks to 180 feet in the valley of the Avon, and rises again to 390 feet where it passes through the Chilterns; and with the Severn by one starting at 425 feet above sea-level, and making a rapid descent of about 250 feet in 3 miles after passing through the Tardebigge tunnel.

It has also to be noted that, in addition to railway competition, the inland waterways of this country have to encounter that of the coasting trade, and when all the drawbacks of English waterways are considered, it is not too much to say that in proportion to their capacity as regards volume and speed, the work done by them compares very favourably with that done by the waterways of other countries with which it is reasonable to make a comparison. In the absence of ton-mile statistics no satisfactory comparison can indeed be made under this head; still, it may be not altogether useless to mention that the tonnage carried by the waterways of England and Wales, according to the returns for 1898,* was larger than that carried by the waterways of France, Belgium, Germany, or Russia, for the nearest year for which I happen to have the data (in no case more than three years from 1898). England and Wales, moreover, have no waterway like the Ruhr, capable of carrying 165-ton boats and passing through a coalfield, yet carrying next to nothing. The 113,000 tons carried in 1898 by the Kennet and Avon canal and river Avon (railway controlled, be it observed) compares very favourably with the small traffic of the Danube-Main or Ludwig's canal.

The first question, therefore, to ask is, How is it that our poor waterways accomplish so much? and unquestionably the answer is, Because this country has such large quantities of bulky goods originating or

* 'Returns in Respect of Canals and Navigations in the United Kingdom for 1898. [Cd. 19], 1899.

collected at some point on a waterway and requiring to be transported to some other point on the same or a connected waterway.

We may next ask how this traffic is divided between the independent and railway-controlled waterways. In making this comparison, I leave out the sea-borne traffic of the Manchester Ship canal, which is obviously not on the same footing as ordinary inland water-traffic, and I omit the Manchester Ship canal proper in stating the total length of the canals. On this basis we find that the 2016 miles of independent canals carried in 1898, in round numbers, 22·5 million tons, the 1118 miles of railway-controlled canals roughly 13·5 millions. These figures would seem to tell rather in favour of railway control, but, of course, it would be absurd to draw such a conclusion. Such general comparisons throw no light whatever on the question. It will be more profitable to look at the facts relating to some of the individual navigations.

That which carried by far the greatest amount in that year was the Birmingham Canal Navigation, a miserable narrow-boat system of waterways which wind about and rise and fall in South Staffordshire and the neighbouring parts of adjoining counties. But it is their situation that explains their pre-eminence, the large towns and the mines and quarries of this district supplying and requiring large quantities of bulky produce, such as is indicated in the following table, one column of which is taken from the returns already cited, and the second kindly supplied to me by the clerk to the Navigation :—

THOUSANDS OF TONS CARRIED BY THE BIRMINGHAM CANAL NAVIGATION.

	1898.	1905.
Coal	4543	3786
General merchandise	1340	1336
Bricks	846	612
Road materials and manure	655	769
Pig iron	523	434
Ironstone and cinder	478	411
Sand	139	135
Lime and limestone	103	63
Total	8627	7546

The "general merchandise," I am informed, is broadly composed of grain, timber, and manufactured goods generally.

The waterway ranking next after the Birmingham Canal Navigation in respect of the volume of its traffic is the Aire and Calder Navigation. Here we have a much better waterway, throughout above 6 feet in depth, with much fewer locks, and, moreover, with large quantities of one bulky commodity (coal) to collect at or near its upper terminals, Leeds and Wakefield, and discharge into ships at its lower end, Goole. This trade has also been greatly promoted by the ingenious contrivances for dealing with this commodity devised by the engineer to the canal, Mr. W. H. Bartholomew, M.INST.C.E. The coal is carried in so-called

compartment boats, really segments of a boat, each carrying 35 tons of coal, and formed into a train which is preceded by an empty segment shaped like the prow of a boat, all drawn by a tug. On the arrival of the train at Goole, each compartment is hoisted up in order that its contents may be tipped into the hold of a ship, and on the return of the train the separate compartments are hauled out of the water on rails to be taken to the collieries for refilling.

Time fails us for the examination of other important English waterways, but attention may be drawn to two railway-controlled canals which carry a great deal of traffic, though not with such satisfactory results as the Birmingham Canal Navigation. One of these is the St. Helen's or Sankey Brook canal,* belonging to the London and North-western Railway Company. It is above 6 feet in depth, and runs from the great chemical and glass manufacturing town of St. Helens to the Mersey. In 1898 it carried above 380,000 tons of river sand, chemicals, limestone, sugar, and other produce, but at a loss to the company of £835. It is difficult to conceive what motive the company could have for carrying all this at a loss, if in any way it could contrive to carry it at a profit. The other is a very remarkable and instructive case in more ways than one. It is that of the Swansea canal,† which lies in the valley of the Tawe, and in 16½ miles ascends 333 feet by means of 36 locks. In spite of these adverse circumstances, the canal carried in 1898 192,000 tons at a small profit to the railway company. The explanation is found, however, in the account of it given in the Returns for 1898, where the canal is described as "passing through or alongside the various works—copper, silver nickel, tin-plate, and other works, also collieries, quarries, etc." But the instructiveness of this example does not end here. In 1898 the goods stated to have been carried by this canal in order of importance were coal, ores, and pitwood. The manager of the Great Western Railway Company has been good enough to inform me that in 1905 the total tonnage carried by this canal was only 123,000 tons, and that the decrease in traffic was mainly due to the fact that, consequent upon the provision of rail access to a large colliery company's works, that company's output, which formerly passed by the canal, was now all carried by the Midland Railway, and that it was understood that the colliery company had disposed of its water-carrying plant. The coal at present carried by the canal amounts to less than 6000 tons per annum, and I am assured that, as might be expected, practically the whole of the canal traffic arises at, or is destined for, places in the vicinity of the canal. Now the traffic is carried on at a loss, and in this case it is still more difficult to conceive what inducement the company has to suffer that loss if it can prevent it.

* This is the canal shown on our map by five large dots to the north of the Mersey.

† This canal, inadvertently shown on the map by a continuous instead of a dotted line, is the western of the two canals converging on Swansea.

There can be no question, however, that in some cases it must be the interest of the railways to check the development of canal traffic. If the facilitating of traffic on a canal belonging to a railway would tend to divert traffic to other canals instead of the railway, it is in accordance with ordinary business human nature that the railway should be unwilling to grant such facilities, and it is largely on this account that the principal schemes for canal improvement in this country hinge upon the Birmingham Canal Navigation. That, of course, is not the sole reason. The concentration of a mining and industrial population on the area served by that canal affords one of the important conditions favouring through traffic by water to the coast. In the paper already referred to M. Saner has propounded a scheme for connecting this area with the ports of Liverpool, Hull, London, and Bristol by canals capable of being navigated by lighters of 250 tons carrying capacity. But suppose, as Mr. Vernon-Harcourt suggested in his criticism of that scheme, a beginning were made with a project of more modest dimensions, "the actual enlargement of the most promising canal, such, for instance, as the Worcester and Birmingham canal," let us consider, in the light of what has been set forth, what would be the prospects of traffic on that improved waterway to the sea. The Birmingham area, it may be admitted, is more promising for canal traffic than Berlin. It is rather to be compared with a portion of the area of the Ruhr coalfield. Still the waterway thus provided would be no Rhine. It would not even be equal to the Dortmund-Ems canal, the disappointing results of which we have already seen. When all the circumstances are considered, the probability is, it seems to me, that nearly all the commodities enumerated above as making up the water-traffic of the Black Country would still continue to form merely local traffic. Not improbably there would be some development in the carriage of iron manufactures to Bristol, a development hindered, as compared with the Dortmund-Ems route, by the inferiority of the waterway, but relatively favoured through the superiority of the seaports with which Birmingham would be connected. In return there would not improbably be a certain trade in ores, how great it would be difficult to estimate, but so far as it went it would no doubt be a gain to the district. From the experience of Berlin and Germany generally, we may take it as settled that the improved waterway would do little to promote the trade in English agricultural produce. On the other hand, it would help to increase the competition of foreign and colonial produce of that kind with that of home production. Those, therefore, who advocate the spending of public money on canals ought to consider whether this trade, among others, is one that it is desirable to promote by special bounties, such as an unremunerative state-built canal would constitute.

Before the paper, the CHAIRMAN (Colonel G. E. CHURCH, Vice-President): This evening we have a lecture on an extremely interesting subject—Inland Waterways

—by Mr. Chisholm, whom you all know. He has devoted the last twenty years to the question of practical geography, and the world is greatly indebted to him for the work that he has done. His treatises, text-books, and atlases are well known, and his 'Commercial Geography' is a standard not only in the English language, but it rivals any similar work in any foreign tongue. Naturally, his researches have led him to study inland waterways in all their relations to the commercial development of countries, and therefore we may expect from him information of no ordinary value this evening. I have now the pleasure of calling upon him to read his paper on "Inland Waterways."

After the paper, Sir Charles Watson: It is to be regretted that Mr. Vernon Harcourt is not here to-night, because he could have given us most valuable information on this subject, but unfortunately he is abroad. I have been his colleague at two International Navigation Congresses in Italy and in Germany, and have had the opportunity of seeing some of those places which Mr. Chisholm has described, and of discussing this question with foreign engineers and others who are interested in the subject. I have also lived for more than a year on the banks of the Mississippi, and have had considerable opportunity of studying the important question of navigation on that river. The conclusion that I have arrived at is, that the conditions of inland navigation in every country are different. If we take, for instance, Holland, where there is a flat country, and where there are canals without locks, they are undoubtedly most valuable. There is another country, in fact, two countries, that Mr. Chisholm did not mention, where inland waterways are of the greatest possible value. I allude, of course, to Norway and Sweden. There you see carried out to the fullest extent what he regards as one of the most important principles—that is, that the goods which are to be carried can be brought without difficulty from the point where they are produced to the point where they are required. I allude to the great timber traffic in Scandinavia. There, too, you have the curious fact that the ice and snow, which in most countries hinder waterway traffic, are really of the greatest assistance. If you are there in winter, you see that they are able to bring down the trees from the forests by chutes on the snow, and are able to float them down without the least difficulty to the point where they are to be shipped. In countries like these, where the rivers bring down many thousands of tons of timber every year, waterways are of the greatest possible value. But if, on the contrary, you have a country like England, where the surface is undulating, where there must be numerous locks, and where there is not always enough water to serve those locks, it is very doubtful whether canals can ever be as useful for us as railways. It must not be forgotten that canals were introduced into England at a time when railways were not thought of. Prior to the introduction of canals in the eighteenth century, all the traffic had been carried by road, and, for the most part, by bad roads. Of course, Telford had not then made his excellent roads, and many of the routes were of a very inferior description. Canals were a vast improvement; but in the early part of the nineteenth century the railways were introduced. It must not be forgotten that one of the main reasons which was urged for the introduction of railways was that they would be very superior to canals, because the prices charged for traffic on canals was so high that it was considered the railway would help to reduce those prices, and would take the traffic more conveniently. Having regard to all the circumstances of the case—though I speak with hesitation on the subject, because there is at present a Royal Commission sitting, and I think we ought perhaps to wait until we hear the results of their deliberations, which will give us the latest ideas of canal traffic in the United Kingdom—I cannot help feeling that it would not be justifiable to spend either

the money collected by taxes or by rates on British canals for the sake of some manufacturers and traders. I do not see why the whole of the community should pay in order that a small proportion should get their goods carried a little cheaper. But at the same time I would only say that it is a most interesting subject, and that the more you study it—and I suppose it is the same with all subjects—the more you find how much there is to learn.

Sir HENRY TROTTER: My only excuse for saying two or three words is the fact that I have lived for the last twelve years on the banks of the lower Danube, a river which has only been casually alluded to this evening. It rises in the Black Forest in Germany, and has a course of about 1200 miles before it reaches the Black sea. I have only had to deal with the lower part of the river, that is, the last hundred miles of its course. That hundred miles is under the jurisdiction of a European Commission, which was constituted in 1856, after the Crimean War, with the mission of clearing the mouth of the Danube from obstructions. Instead, however, of lasting for two years, as originally intended, its work has been so successful that it has lasted for fifty years instead of two, and celebrated its jubilee last year. When the commission first began its labours there were 9 feet of water on the bar and 8 feet in the river. Early in 1894, when I first became connected with the Danube, those dimensions had increased to 24 feet on the bar and 18 feet in the river. At the present moment we have 24 feet on the bar and 20 feet in the river, and it is most gratifying to know that the success of those engineering works is almost entirely due to an Englishman, Sir Charles Hartley, a most distinguished engineer, who, after serving in the Crimea during the war, was appointed engineer to the Danube Commission, and up to this day, fifty years later, he is still its consulting engineer, although about to retire next month. I will give you some idea of the advantage that has accrued to commerce from the improvement of a single waterway. I must confess I was rather startled at the figures given by Mr. Chisholm. Till I heard them, I always had a much higher opinion of the Danube than I have at this moment, because I find there are so many canals in our own country which carry a greater traffic than the Danube. From 1850 to 1860 the average annual number of British ships entering the Danube was 205, with a mean capacity of 195 tons. From 1896 to the present date the average number has increased to 420 ships with a mean capacity of 1769 tons. The largest record of British ships was in 1893, when there were 905 vessels aggregating 1¼ million tons, capable of carrying about double that amount of cargo. In that year British shipping accounted for 88 per cent. of the total shipping frequenting the Danube. The principal exports from the Danube are cereals from Roumania and Bulgaria, and timber from the Carpathian mountains. The export of cereals from the Danubian ports in 1867—the first year for which authentic records are available—was 2½ million quarters, which is about the average of the ten preceding years. Forty-two years later it was 17½ million quarters, while the average for 1893 to 1895 was 12½ million. In the same interval freights from the Danube to the United Kingdom have fallen from 45*s.* to 10*s.* per ton, or from 9*s.* to 2*s.* per quarter.

Mr. HENRY HUNTER (chief engineer of the Manchester Ship Canal): My only apology for intervening is that for thirty-four years I have been engaged in the construction and in the operation of inland waterways, and I cannot but feel that something should be added to the observations which have been addressed to us to-night by the author of the paper. I began my connection with inland waterways in the reconstruction of the river Weaver navigation in the county of Chester in the year 1873. Mr. Chisholm has spoken, and spoken with accuracy, of several cases in which waterways have been found, by those who controlled them, for one reason or another, unable to compete with railway-borne traffic. The river Weaver

Navigation, upon which the main traffic is the carriage of salt, is an exception to that rule. From the inception of that waterway efforts have been made to keep it up to date, and the result is that, although for nearly fifty years desperate efforts have been made by some of the greater railway companies, including the London and North-Western, to divert the traffic from that waterway to their own routes, their efforts have been entirely unsuccessful: so that the traffic continues still to be borne on the waterway despite the competition of the railway companies. Then again, I have been connected for nearly a quarter of a century with the Manchester Ship Canal, and I ask to be allowed to supplement, from the point of view of our experience in connection with the railways, the observations which the lecturer has made. I have been engaged for some considerable time in extending the terminal accommodation of the canal in Manchester. In the year 1905 His Majesty the King opened a large new dock. A few weeks before the dock was opened, Sir George Nares came over to see these new dock works, and he brought with him a gentleman who is an officer of the Board of Trade, and who spoke of a well-known Manchester merchant, and said, "I was dining at his house last night, and I told him that I was coming down to see the Manchester Dock. And he said to me, 'My firm has £40,000 in ordinary shares in the Manchester Ship Canal. We have never received one halfpenny of dividend; we never consigned a bale of goods by it; we have neither imported nor exported by it. And yet,' said he, 'we think that we never invested money to greater advantage.'" Now, that point of view has been omitted by the lecturer to-night. Sir Charles Watson reminded me of it. He was the British representative at the St. Louis Exposition, and at St. Louis I had the opportunity of saying something about the inland waterways of this country, and of referring to certain figures which were to illustrate the point. A manufacturer in the Potteries District had, as it happened, in 1904, orders in his works for considerable quantities of pottery goods for London and for New York. The goods were in his packing warehouse at the same store, and, through a mistake on the part of the packers, some of the crates which were intended for London were sent to New York. The error was not discovered until they were well on their way across the North Atlantic, when a cable was sent, saying, "Send crates back direct to London." That manufacturer was able to show that the crates which he sent directly from Tunstall to London cost him the ordinary rate of 25*s.* per ton for railway carriage, while the crates which he sent from Tunstall to New York, and thence to London, cost him 15*s.* per ton. So that it may be said that the cheapest route from Tunstall to London is *viâ* New York. I suggest to you that the point of view relating to reduction of railway rates by canal competition ought not to be lost sight of in considering the question of the value of inland waterways in this country.

Mr. Herbertson: When Mr. Chisholm addresses us he always gives us something to think about. To-night he has shown us an example of his skill in dealing with the very complicated problems of economic geography, a skill which has given him the position of one of the leading authorities, and made his book the best book, on the subject.

I agree with the speaker who said that the more you study the problem of inland waterways, the more complicated it becomes. It is very easy to give many instances of this. Some canals can carry coal at a profit, other canals cannot do so. In some cases coal is brought by rail because the railway station is at a higher elevation, and it is easier to cart downhill than uphill. Where the canal is higher, coal may come by canal for the same reason. As Mr. Chisholm has pointed out, one has to be very cautious. The case of the Erie canal is an example in which caution has to be used in coming to conclusions. In 1905, on the Erie canal

every available boat was in use, and some were such rotten hulks that the insurance companies would not insure the cargoes. That was due to the Erie canal being in a transition stage, and hence we cannot draw satisfactory conclusions from the present state of the Erie canal traffic.

Mr. Chisholm very rightly insisted on the importance of quick delivery, but occasionally one finds the waterways are chosen because they are slower, even when more expensive. In the reports issued by the Foreign Office, you will find an account of how, when the Russian wheat comes into Antwerp in autumn, part is sent to Strassburg by the Rhine in fifteen days at 6*s*. 6*d*. per ton. Another part is sent eastward to the Meuse and along the Rhine and Marne canal to Strassburg, taking six weeks and costing 9*s*. 6*d*. per ton, but the importer at Strassburg saves warehousing and gets delivery after he has disposed of the wheat brought up the Rhine.

This problem of inland waterways has very properly been brought before the Geographical Society, because the geographical factor is very important in this as in all transportation problems. At first sight transportation services would seem to overcome the geographical factor, but the great centres and routes of traffic are very definitely controlled by geographical conditions, and, indeed, the geographical factor becomes more instead of less important. The orography of the country has to be examined very carefully. The water-supply has to be considered from a political as well as from a physical point of view. One must know, not merely how much water there is, but what water is available, and a map is required showing exactly how much water can be obtained at the present time that is not assigned to other purposes. The geographical factor comes in the economic as well as in the engineering problems of inland waterways, and it would be easy to add to the illustrations of this which Mr. Chisholm has given. Here, too, new maps, showing not merely actual economic conditions, but economic potentialities, are badly wanted.

There is one aspect which Mr. Chisholm has not emphasized to-night, and that is the value of comparative geography in the problem. The south-eastern counties of England have orographic conditions very similar to those of the Paris basin, with alternate scarped ridges of porous limestone or chalk and impervious clay plains between. The rainfall and the conditions of water-supply are not very different. The agricultural conditions may be a little better in the Seine basin owing to the more southern latitude. A careful analysis is needed to show how far, with fairly similar physical conditions, the economic conditions of the two regions differ. This has a practical bearing on the problem of inland waterways in this country, because it is stated that along the Rhine-Marne canal a very large proportion of the traffic is due to industries which have sprung up since the canal was constructed. But another precaution has to be taken, because there have been great improvements in methods of transport by road, rail, and water since this canal was made. Before coming to conclusions from French conditions, we have to take into consideration, not merely comparability of the physical and economic conditions, but how far recent improved methods of transport affect the problem.

Mr. Arthur Lee: As one of those who took an active part in the agitation which brought about the appointment of the Royal Commission, and as one of the two witnesses nominated by the Associated Chambers of Commerce to give evidence before that commission, I am glad of the opportunity of saying one or two words. I was very glad to hear what Mr. Hunter had to say, because this appeals to me rather more as an economic than as a geographical question. I think everybody in this room will agree that cheap transport is a national advantage. Where do we find that transport is cheapest? What are the countries in which transport is cheapest? We find, invariably, that transport is cheapest where water-communica-

tion is best. The railway rates generally in existence in this country have been carefully compared with the rates charged in European countries. We pay on an average 8 per cent. more than the French, 31 per cent. more than the Germans, 33 per cent. more than the Belgians, and 35 per cent. more than the Dutch. Now, how has that reduction been brought about? There is an invaluable paper—a Foreign Office paper—which was written by Consul-General Hertzlet a year or two ago, and he points out that, in consequence of the improvement of the waterways in Belgium and in Germany, illustrations of which you have seen here to-night, between 1888 and 1903 a selected series of rates have been reduced by 30 per cent. Why has no improvement taken place in England? It is because of the policy pursued by the railway companies towards the canals. They have been left, to use the lecturer's words, to fight it out between themselves, with the result, that the railway companies' rates, where there is no effective water-competition, are very much higher than the rates where there is effective water-competition. I have examined a number of railway rates from the two important ports of Bristol and Hull. The average comes out in this way. Where there is effective water-competition, other things being equal, the rates are 38 per cent. lower than to points where there is no such competition. The Birmingham district has been alluded to by the lecturer to-night, and he has suggested there is only local traffic there, and only likely to be so in the future. Now, some two or three years ago it was my duty to go to Birmingham to see if I could rouse the Birmingham people to action in this matter, and I pointed out then, that the district imported something like three million tons a year of timber, grain, copper, tin, lead, and zinc, and that by an improvement in the canal communication of the Severn they might save probably something like half a crown a ton. But if they saved only a shilling a ton, that would be £150,000 a year, and it might be profitable to the district to provide public money for that particular purpose, for the reason that, as all consumers benefit by competition amongst traders, all consumers pay rates for carriage, whatever they are, in the long run. But it does not pay private persons to expend money on the improvement of canals, because immediately they do so the railways make a dead set at them, and make that particular traffic point unprofitable. They are able to do so by charging higher rates to places where there is no such competition. But it would pay the whole community to put a waterway in order, even if not a ton of goods passed by that canal, if as a consequence they were able to get lower railway rates. May I point out to you that in America, which has been suggested as a place from which we might gain important lessons, when the water routes are blocked by ice, the railway rates go up for those particular months of the year. And Commissioner Finke, of New York, has said with regard to the Erie canal, over which only a small percentage of the total traffic goes, that the railway rates are kept in check by water-transportation. This explains why New York State is ready to spend 21 millions in improving that canal. The real point is that the railways have a practical monopoly in this country, and the only means of combating this monopoly is by means of canals, within limits, of course. Nobody knows better than those who have studied the subject, that canal traffic must be conducted under very strict limitations. I don't want anybody here to be alarmed at the suggestion which has been made to-night by one speaker, who said he did not see why public money should be expended to enable some people to get their goods cheaper. Now, I have never advocated the expenditure of State money; I have spoken against it—unless with local guarantees. If you have local guarantees and a local provision of some money, you can then safely give State aid, because the State gets its interest guaranteed locally, and the taxpayers are guaranteed against loss by the particular district which is benefited by cheaper freight. With these limitations, I do not see

why there is any geographic, economic, or engineering difficulty in the way of providing public funds to enable us to put our waterways into order, at all events in as good order as they are found in the great commercial countries of the Continent.

Mr. PALMER: The last speaker has mentioned the very points that were in my mind, and he has covered so well the grounds of Mr. Hunter's narrative, which shows how cheap water-carriage is to be obtained, that at this late hour I do not think I can usefully say anything further. The lecturer spoke of the canals between Liverpool and Wolverhampton as being of very small gauge, but notwithstanding that, they carry a very large amount of traffic. That shows that although the canals work at a great disadvantage, it shows the value of water-carriage. The annual tonnage in England and Wales, according to the last Board of Trade returns, was, I think, something more than 34,000,000 tons. It should be remembered that this 34,000,000 tons is with very antiquated canals. On the French canals they have only arrived at about the same tonnage—I forget the exact figures—after having improved their canals and spent something like sixty millions on them. They thought it worth their while to improve their canals when their tonnage was very much smaller—I think under 20,000,000 tons, but I am not sure of the figure—and if it was worth their while to spend such a large amount of money to improve their canals in order to get cheap carriage, well, it is worth while for something to be done in England to make improvements which will give us cheap carriage. We have been called a nation of shopkeepers, but, at any rate, we are behind other nations in the matter of cheap carriage.

The CHAIRMAN: I take the view that canals are a national blessing, for they modify the pretensions and the monopoly of the railways, and I quite agree with Mr. Lee's view—in fact, I am indebted to Mr. Lee for saving me from making some remarks similar to his own. Canals really dictate low railway tariffs, and every nation could afford to undertake the cutting of them for Government account. Take the Erie canal. Twenty years ago it cost 2*s.* to send a bushel of wheat from Chicago to New York. Thanks to that waterway, it now costs 5*d.*, and the New York Central Railway is absolutely obliged to base its tariffs on the cost of carrying grain by the Erie canal. There are twenty-seven railway bridges across the Mississippi to-day, indicating the terrific competition between railway and water-borne freights. Throughout the United States the rivers and canals have made freights as low as they are; the average railway rate there to-day is two-thirds of a halfpenny per ton a mile. It will be lower, for the United States has in hand eighty million sterling projected outlay for improving its waterways, and there is now a Bill before Congress for the expenditure of seventeen million sterling on account of that eighty millions. The large project from Chicago to New Orleans which has been mentioned will also bring the railways to a realizing sense that it is their duty to the public to carry freight as low as they can and make a reasonable interest on a proper capitalization. I have no doubt the Danube regulates the railway rates in Austria and Hungary, that the Suez canal even influences the rates on the Trans-Siberian Railway, and that the principal value of the Panama canal will be to lower trans-continental railway freights. I am not going to detain you any longer. The subject with its ramifications is so vast that we might continue talking about it for a month. We have only to thank the lecturer for his extremely interesting paper, and also the gentlemen who have taken part in the discussion, which has given additional value to the lecture.

Mr. Chisholm, at the meeting, confined himself to a brief expression of thanks and of gratification at the discussion that had been raised by his paper, and excused himself from replying on account of the lateness of the hour. He now desires,

however, to take the opportunity afforded him of replying to criticisms. Some of the omissions to which attention was called were due solely to the necessity of compression, more particularly in the reading of the paper, some of the points referred to as overlooked being expressly noted in the paper as written and printed. Several instances of transport costs adduced by different speakers serve very well to show how complex the problem of transport is, but they may be described as belonging to the curiosities of transport, each demanding special inquiry, whereas in the paper an attempt has been made to ascertain the normal and typical. The objection most frequently urged by critics was that in the paper the indirect influence of low water rates on railway rates was overlooked, and it was contended that indirect benefits of this kind may more than make good direct losses on water transport. The fact of such indirect influence is unquestionable. The author of the paper, in the later editions of his 'Commercial Geography,' has quoted without one word of dissent the opinion of an American railway-traffic manager to the effect that the influence of the Mississippi in the making of rates is almost conterminous with the Rocky mountains on the one side and the Atlantic on the other. In the case of effective paying waterways like the Aire and Calder and the Weaver navigations, the influence, both direct and indirect, on transport charges must be regarded as wholly salutary; but, in reply to those who think that this consideration would justify the expenditure of public money either derived from the general revenue of the country or (less objectionably) from the districts principally interested in canals not expected to pay directly, the author of the paper would invite attention to these considerations, which, it must be confessed, take us rather far from the field of geography. It must be admitted that the indirect influence of navigations like the Aire and Calder and the Weaver would be still greater if these navigations renounced all profits on their business, but no one surely would contend that in the interest of the general public it is their duty to do so. If it is recognized as reasonable that such private companies should earn such profits as they can, it would seem to be reasonable, also, that waterways constructed with public money should be made to pay if they can. Now, it cannot be questioned that any benefit that would accrue indirectly to the general public from the construction of a waterway with public money must come through the traders. They must benefit not merely primarily, but chiefly, and, above all, those traders who deal in the commodities in which waterways are able to compete most effectively with railways. If, therefore, it is proposed to construct with public funds a waterway which admittedly will not pay under the existing conditions of competition, it would appear to be reasonable for the district supplying the money to ask for powers to levy contributions in support of the waterway from those traders who would principally benefit by it whether they sent goods by the waterway or not. Otherwise the benefit is distributed out of proportion to the burden. Let us suppose, then, that powers were granted to levy rates in the interest of the waterway on railway-borne goods, especially of those classes in respect of which the competition of waterways with railways is most serious. What would the effect of that be? The railways have, in consequence of the indirect influence undoubtedly exercised by the waterway, reduced their rates compulsorily. This levying of rates in the interest of the waterway would be in effect a raising of the railway rates, but not an undue raising so far as the traders are concerned. Much of the traffic would thus be driven to the waterway. The waterway might thus be made to pay, but would this method of making it pay not bring into glaring relief the injustice that would be done to the railways?

THE ORIGIN AND INFLUENCE OF THE CHIEF PHYSICAL FEATURES OF NORTHUMBERLAND AND DURHAM.*

By DAVID WOOLACOTT, D.Sc., F.G.S., Armstrong College, Newcastle.

In a paper on "England and Wales viewed geographically," Dr. Mill has shown that geology to a certain extent, and geography to a far greater, derive much of their interest from the causal idea. (1)† Geological and geographical phenomena may be considered from two distinct standpoints, firstly, from that of their origin and development—mainly the province of the geologist—and, secondly, from that of their bearing on humanity, its places of settlement and lines of movement, chiefly the work of the geographer. When the geologist views the topography of a country, he sees a series of panoramic changes leading up to the present configuration; but to the geographer the existing contour is in its broader outlines unchangeable, and he endeavours to trace the influence that this immutability of the surface has on mankind. In this paper I desire to examine the physical features of Northumberland and Durham from two separate, but closely connected, positions, viz. that of their geographical evolution, and that of their influence on the determination of the place of town and city, and routes of migration and commerce.

The Pennine chain and Cheviot hills form the main gathering-grounds for the waters that flow over the two north-eastern counties. The former is a faulted anticlinal of Carboniferous rocks, the latter is an igneous massif of the Old Red Sandstone age. From them the rocks dip gently towards the east and south-east, and the rivers are, and in former times were much more, adjusted to this fundamental geological structure. The time at which the evolution of the present topography of Northumbria began is hypothetical, as it is almost impossible to fix with any certainty the period when the era of deposition gave place to that of denudation.

From the available evidence, it is impossible to make any definite assertion as to whether the Pennines were ever entirely covered by any of the deposits of the Mesozoic age; it is, however, clear that the extent of country that was covered by the Upper Cretaceous sea would be such that very little denudation would be taking place within the two north-eastern counties of England, and, consequently, the initiation of the present topography of the country would not take place until the post-Cretaceous uplift. If any one desires to pursue this subject further,

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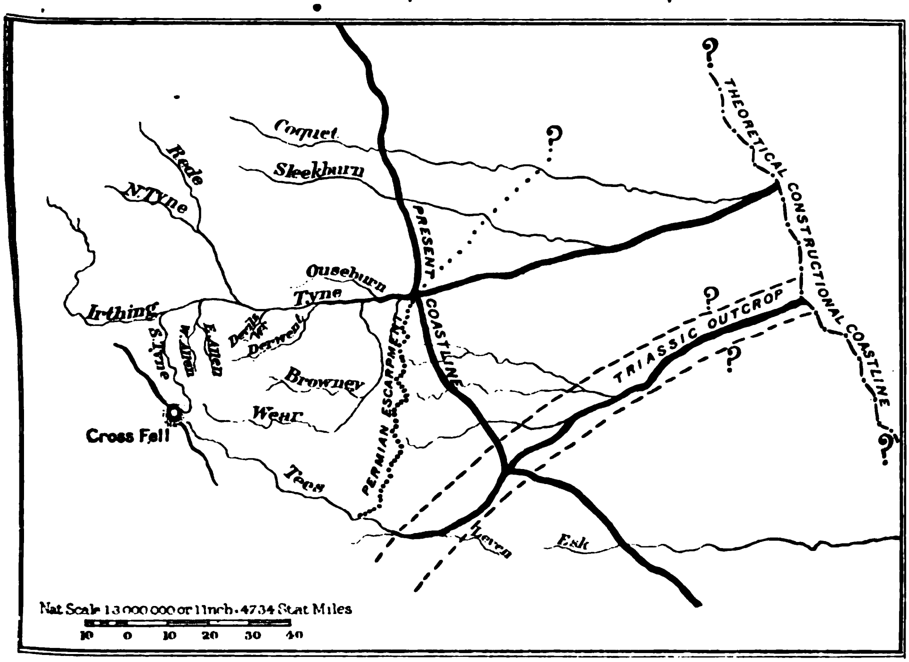
* Research Department, April 19, 1907. Sequel to a paper on "The Superficial Deposits and Pre-Glacial Valleys of the Northumberland and Durham Coalfield" (*Quart. Journ. Geol. Soc.*, vol. 61, 1905, pp. 64–96).

† Numbers between parentheses refer to Bibliographical list at end of paper.

reference should be made to papers (2) to (5), whose titles are given in the bibliographical list annexed to this paper.

The movement of elevation that began in early Tertiary times, and culminated during the Miocene period, ushers in the most influential cycle of river development in the two north-eastern counties. It made Britain throughout the Tertiary age a part of the European continent, and the greater portion of the area at present occupied by the North Sea, dry land. The elevation was greater in the west, and the land sloped gently from the Pennines towards the east, corresponding roughly with the dip of the strata; thus a series of consequent streams, having

Map of Northumberland and Durham showing the direction of the chief rivers prior to the Glacial period.



their source in the Cheviots and Pennines, was initiated. The constructional shore-line probably lay far to the east and north of the present coast-line; indeed, for a considerable period all the rivers were tributary to a major stream running along the middle of the North Sea area. An era of sub-aërial denudation held sway over Northumbria, and continued without a break from the Miocene to the Glacial period. It was during this protracted epoch that the pre-Glacial valleys of the northern counties were developed, the escarpments of Tynedale and Weardale gradually evolved, (6) and the broader features of the present topography produced. The chief escarpment of the two counties is that

of the great intrusive sheet of the Whin Sill, which runs in an almost continuous scarp across Northumberland from Gilsland to the north of Belford. The outcrop of this rock has been of considerable historical importance, and is of some geographical interest. Along it for about 18 miles the Roman Wall of Hadrian was built, and the castles of Dunstanborough and Bamborough, which in early days acted as foci for places of human settlement, were erected on it. The Northumberland lakes partly owe their origin to it, and it has added to the beauty and variety of the northern coast of Northumbria.

The most noticeable feature of the uplands of the two north-eastern counties is the centric development of the South Tyne, Wear, and Tees, which are all dip-streams flowing from the Crossfell area. This arrange-

THE WHIN SILL ESCARPMENT, WITH CRAG LOUGH LYING AT ITS BASE.
(*H. Mitchell, photo.*)

ment appears to have been produced by the uplift of the Pennines having been accentuated in the region, where the culminating summit of that range lies. In the north of England the Pennines form a complete water-parting between the east and west of England, except along the line of the Tyne Gap, which is a valley cutting across the Pennines at an elevation of less than 500 feet, and consequently forming a natural commercial route between the east and west of Northern England. This gap, as well as the development of the South Tyne, Wear, Tees, and other streams from a central area, can be clearly seen on any physical map of England. Mackinder, in his 'Britain and the British Seas,' (7) suggests that the source of the Tyne once lay in the region of the Solway Firth; that the Nith and Annan were its head-waters; and that the Tyne Gap, though ultimately due to a local

downfold transverse to the Pennines, was the former course of the upper Tyne. On this hypothesis the Eden, a river possibly of later development, whose valley is cut in the soft and unresisting New Red deposits, must have caught up these headwaters. It seems much more probable that this transverse valley has been eroded by the Irthing, now a tributary of the Eden, but which has been proved to have been, even in post-Glacial times, one of the Tyne. (8) This easterly flowing stream would be confluent with the South Tyne, which from Haltwhistle to Hexham is a strike stream. It was also during this period that the valleys of the southerly flowing Redewater and North Tyne, and those of the easterly flowing Tyne and Coquet were developed. The drainage of the west of Northumberland is quite distinct from that of the east, a feature due to the Corbridge fold, the axis of which runs from the Cheviots to the Tyne, near where Corbridge now stands. Prof. Lebour says of this structure, "It was a long, low-arched saddleback or anticlinal, the result of which was that only to the east of it did the beds dip steadily to the east, whereas on the other side they either lay flat or gently rolling."(9) The influence of this fold in separating the river-basins of the North Tyne and Redewater from that of the rivers flowing eastward into the North Sea has been considerable. Its axis forms a watershed dividing the drainage of the west of Northumberland from that of the east. The valleys of the Tweed and its tributary the Till, which flows along the eastern foot of the Cheviots, were also formed during this cycle.

Cowper Reed, in his 'Geological History of the Rivers of East Yorkshire,' shows that at the beginning of this epoch the Wear would be a tributary of the Tees, which flowed right across the Jurassic outcrops in the line of the present Leven and the Esk. Both these rivers were afterwards beheaded by subsequents; the Wear by a tributary of the Tyne that had developed along the edge of the Permian escarpment, and the Tees by a parallel stream, which had worked back along the Triassic outcrop. (10)

During this era between the Miocene and Glacial periods the pre-Glacial valleys of the northern coalfield were produced. In my paper on these valleys, (11) it is proved, from a study of the borings made in that area, that the present rock-surface of the country lies, in a great number of places, at a considerable depth beneath sea-level, reaching a maximum of 141 feet, and that the trend of these points is along certain more or less clearly defined lines—the paths along which the pre-Glacial streams ran. These valleys, now filled or partly filled with superficial deposits, are shown in most cases to be the continuation of the higher reaches of the present river courses, and in others to bear little or no relation to them. They, however, afford us a means of reconstructing, with tolerable accuracy, the drainage prior to the Glacial period; besides, they prove that during this cycle of river development the land must have stood higher than at present. The pre-Glacial Wear, flowing along the partly

filled valley of the "Wash," debouched into the Tyne; the trend of the last-named river in that era was very similar to that of the present one; while the pre-Glacial valleys of the "Sleekburn" and the "Druridge" existed further north; and in his 'Great Ice Age,' Prof. James Geikie proves that the pre- and post-Glacial courses of the Tweed differ from one another considerably. (12) It is shown in my paper that the slope of the rock-floor down the Tyne valley is not—so far as can be gained from the borings made along it—uniformly eastwards, but as the valley form can be traced down its entire length, there seems to be no other possible explanation of the origin of this valley. (13) The peculiarities of its slope, which appears to be of a switchback nature, must be due—if they really exist—to differential earth-movements subsequent to its development. Besides the major pre-Glacial valleys, there are numerous minor tributary watercourses; indeed, all the so-called "washes" that occur on the surface of the northern coalfield are of this nature.

It is only in the uplands of the northern counties that the primary adjustment of the rivers to the dip and strike of the rocks holds good now, because only in these regions are they flowing entirely over the rock-floor; in the lowlands the streams now run over a varied platform of rock and boulder clay, and are not adjusted to the lie of the rocks (see p. 44).

The main pre-Glacial valleys of the Tweed, Tyne, upper Wear, and Tees are broad; and the drift which now partly masks them has been levelled out, so that they have become the easiest and busiest routes for the lines of east and west human movement in the north of England, and the chief places of settlement have been fixed along them. Thus Haltwhistle lies at the junction of the pre-Glacial "Tyne Gap" and the South Tyne, Hexham at the junction of the Tyne and North Tyne, while along the valleys of these rivers numerous towns and villages have been erected. Corbridge lies on a wide flat of assorted drift, Newcastle and most of the other large towns of the lower Tyne stand on drift within the line of the pre-Glacial valley. Along the Wear, Stanhope, Bishop Auckland, Durham, and Chester-le-Street are all situated on the course of the valley of earlier development.

It is certain that this period of greater elevation during the Tertiary age is the most important so far as the development of the present topography and physical features of Northumberland and Durham are concerned. During the whole of this long cycle the surface of these two counties was being eroded without cessation by the forces of sub-aërial denudation, and if the conditions had not changed a "peneplain" would have been gradually evolved.

The next cycle of river development commences with the passing away of the Ice age. The ice filled up the major existing valleys and checked their development; it also carried with it the screes lying at the foot of the escarpments, which were rounded and polished and made

less distinct features. Along the valleys little or no denudation had been done by the ice, and except that it had smoothed their sides and rounded off the irregularities of their contour, it had not altered their course. During the period of maximum glaciation there were several iceflows passing over the two north-eastern counties, which, while more or less distinct on the higher ground, gradually merged together on the lower. One swept round the Cheviots from the south of Scotland, and passed southwards over the coastal region of Northumberland and north-east Durham; another crept across Northumberland from the west, filled up the Tyne valley, and turned southwards over central Durham; a local one moved down the South Tyne and united with the last; the Wear and upper Tees formed separate gathering-grounds of their own; while the ice from the Eden valley and the Lake District passed over Stainmoor and then down the valley of the Tees. All the main streams, viz. those from the south of Scotland and western England, and those down the main river valleys, received a southerly component due to the pressure of the main mass of ice occupying the North Sea, which came very near to, although it probably never reached, the coast of either Northumberland or Durham. Many of the valleys of the Cheviots, and some of those tributary to the Tyne, were not filled with ice, and hence

DRY SLACK, SHOWING GAP IN WATERSHED, HUMBLEDON HEUGH, CHEVIOTS.
(*Dr. J. A. Smythe, photo.*)

glacier lakes were formed in them, and the overflows from these have eroded deep, clean-cut, and often quite dry channels across water-

BOULDER CLAY, HENDON BANKS, NEAR SUNDERLAND, AFTER STORM, NOVEMBER, 1903.
(*D. W., photo.*)

sheds. (14) Many such slacks occur on the Cheviots and on the higher ground between the Allen, Tyne, and Derwent.

Also at the end of the period of glaciation the ice appears to have melted from certain districts over which no main sheet was passing, as that of central Northumberland, quicker than it did along the country covered by the main iceflows, and hence ice-dammed lakes occupying large areas were formed, and overflows from these have cut channels across the minor watersheds on the lower ground. Some of the dry slacks occurring on the coalfield to the north-west of Newcastle are of this nature, and the gap in the Magnesian Limestone escarpment at Ferryhill, through which the North-Eastern Railway runs, was also produced in some such manner as that here stated.

After the glacial period the main valleys formed prior to that time were partly, and many of the minor valleys entirely, filled with boulder clay and other superficial deposits, little or no evidence of their existence being left on the contour of the country. The new rivers of the post-Glacial epoch began to carve their valleys under new conditions, on land already partially eroded but standing at a lower level than in the former cycle of river development, and on a new platform of denudation consisting of rock and boulder clay. The valleys of the higher reaches of the pre-Glacial streams which had not been entirely obliterated by the mantle of drift became the natural

waterways of the new era; but as they were partly filled up, new channels had to be cut, and hence a great thickness of the original superficial deposits has been removed or reassorted. The river terraces of the Tyne and Wear, which are found in the former river valley as high as the 300-feet contour-line, were produced from the drift that once filled it up to and above that level. (15) Another consequence of this denudation of the glacial formations is that the Tyne, Wear, and Tees have, in many places along their course and for long distances, wide haughs formed of reassorted drift. The rivers are manifestly not carving out new valleys, but superposing a new watercourse on an older

BOULDER CLAY RESTING ON MAGNESIAN LIMESTONE, HENDON BANKS, NEAR SUNDERLAND. LOCAL ANGULAR FRAGMENTS AT BASE OF CLAY, AND FOREIGN SUB-ANGULAR BOULDERS ABOVE.

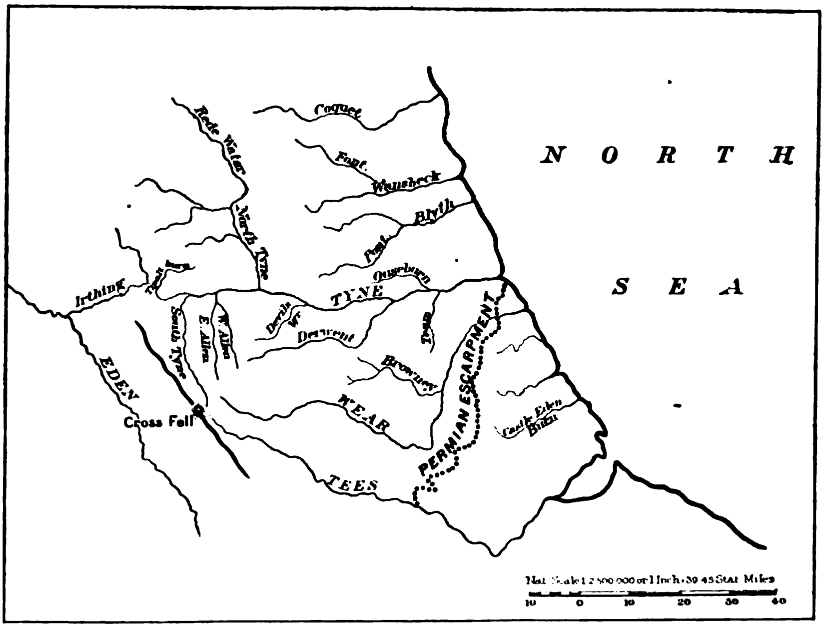
(*D. W., photo.*)

one of larger, broader, and deeper dimensions. The wide alluvial flats have evidently had an important effect on the determination of the direction of the principal routes of commerce, and the situation of the towns and villages. The railways have been laid along the haughs of the post-glacial streams. The Newcastle to Haltwhistle line follows the course of the Tyne, and its principal branches pass into the more secluded parts of the country along the pre-Glacial valleys. The North British branch from Hexham into Scotland creeps along the side of the North Tyne, and the Haltwhistle to Alston along the South Tyne. The main line from Darlington to Newcastle passes into the pre-Glacial

Wear valley near Durham, and then along the "Wash" into Newcastle, while the Wear valley branch follows the course of that river right into the heart of mid-Durham. Newcastle, Blaydon, Hexham, and Haltwhistle lie on the alluvial flats of the Tyne, and Durham, Bishop Auckland, and Stanhope have been erected on those of the Wear.

Along the lower reaches of the rivers many changes have taken place, the tracks of the streams that developed on the new land surface being in many cases totally different from those of the pre-Glacial. Sometimes the newly formed waters have totally left the old valleys and denuded entirely new paths, *e.g.* the Wear from Durham to Sunder-

Map showing the present rivers of Northumberland and Durham.



land; while in others the new rivers keep in the direction of the old thalweg, only deviating from it at certain points, as in the case of the Tyne below Newcastle; also several entirely new waterways have been produced, *e.g.* those of the Wansbeck and the Blyth; and, yet again, some of the ancient valleys were so entirely masked by the superficial deposits that no evidence of their existence has been left on the topography of the country, and they could only be traced by the borings that have been made along them. The "Sleekburn" and the "Druridge" pre-Glacial valleys are the chief examples of such, but numerous minor "washes" exist on the coalfield. The latter can, however, only be clearly elucidated by the thorough examination of each particular

district by local workers. A fuller description of the difference between the drainage of the pre-Glacial and post-Glacial surfaces will be found in my paper on "The Superficial Deposits and Pre-Glacial Valleys of the Northumberland and Durham Coalfield." (16)

Another interesting feature of the new streams is the manner in which some of them are developed along the sides of the partly masked pre-Glacial valleys, and have eroded their new courses through rock rather than boulder clay. This is most probably due to the original surface of the drift having been convex. The best example of this phenomenon is that of the Wear, which from Durham to Chester-le-Street flows along the eastern edge of the "Wash," its wide and deep pre-Glacial course. (17)

The present trend of many of the rivers of Northumberland and Durham differs from that of the earlier cycle. In their higher reaches the new watercourses correspond with those of the former period, but in their lower portions, deviations of considerable moment have occurred. The present upper Wear valley is superimposed on that of the old one as far as Durham, but from that city this river keeps for miles along the side of the "Wash," and finally has developed a new track during the recent period from Chester-le-Street to the sea, breaching the Permian escarpment on its way. The new valley has been denuded since the formation of the raised beaches of the district, which will be discussed later. The Tyne follows the direction of its old path, only deviating from it at Walker and one or two other places, while farther north the courses of the Blyth, Wansbeck, and lower Coquet are new, and the "Sleekburn" and "Druridge" valleys of a former epoch are drowned beneath the drift. Of smaller streams of post-Glacial origin, the Team, which flows over the surface of the glacial deposits along the "Wash," the Don, the Chevington and Seaton Burns are examples. The larger tributary valleys of the Tyne and Wear, such as the East and West Allen, the Derwent, the Rookhope Burn, and the Browney, existed in the earlier cycle of river development, while many of the smaller belong to the later era, as the Newburn and Haltwhistle Burn. In both the present and former eras some obsequent or "anti-dip" streams have flowed into the Wear between Bishop Auckland and Chester-le-Street from the Permian escarpment.

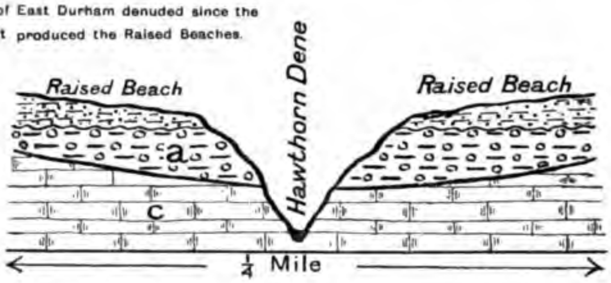
There are five distinct types of valley in the north-eastern counties. The first, of which the Tyne is the best example, is where the post-Glacial river-course, with its broad alluvial flats of reassorted drift, is superimposed on the wide depressed one of the earlier epoch of denudation. The most clearly defined instance of the second is that of the Wear between Durham and Chester-le-Street, where the valley of later development has been eroded through rock along the side of the "Wash" of the former epoch. The third and fourth are entirely of post-glacial origin, and have been denuded since the formation of the

Sections across the principal types of valleys in Northumberland and Durham.

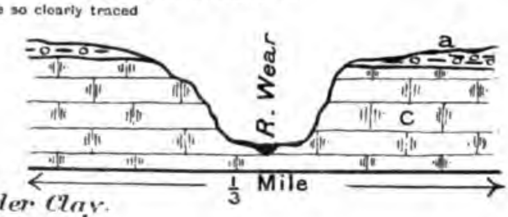
1.—Section across the River Tyne about two miles from the mouth, showing a post-glacial valley superimposed on one of pre-glacial development.

2.—Section across the "Wash" and River Wear, showing a post-glacial valley developed through rock along the side of a deep pre-glacial one, now filled with superficial deposits

3.—"Dene" of East Durham denuded since the uplift that produced the Raised Beaches.



4.—Section across the Wear, showing a post-glacial valley eroded through rock and boulder clay. This type is also later than the raised beaches, but its relation to them cannot be so clearly traced



a = *Boulder Clay.*
b = *Coal Measures.*
c = *Magnesian Limestone.*

raised beaches, being, therefore, of very recent formation. The deep gorge-like "denes" of the Magnesian Limestone area have the beaches exposed on either side of their flanks, and have been denuded rapidly through raised beach, drift, and rock as the coastal region emerged from the sea. The valleys of the Wansbeck and the lower Wear are similar in formation, and have been cut through the superficial deposits down into the rock, but their relation to the raised beaches is not so clear as in the third type; they are, however, of exactly similar origin. The last class is that of the dry valleys or "slacks" of the two counties. Some are pre-Glacial valleys—as the Hopes of the Permian area of east Durham—

DRY SLACK, HUMBLEDON HEUGH, CHEVIOTS.
(*Dr. J. A. Smythe, photo.*)

which have been unfilled by drift; others are the overflow channels of glacier lakes, as the Beldon Cleugh near Blanchland, and the channel across Humbledon Heugh (Cheviots); while others, as the dry slacks, which can be observed near Newcastle, whether cut through drift entirely or through it into the rock, were possibly formed when the ice was finally melting from certain areas, and the water was being dammed back by the main iceflows, which had not as yet finally retreated. Prof. Lebour suggested, some thirty years ago, that the old Northumbrian word "swire" should be given to the deep-cut, narrow dry slacks. (18) This word "swire," or "swyre," is defined as the hollow or defile near the summit of a hill. Some such word, if adopted

to include all kinds of slacks and dry valleys, would prove exceedingly useful.

The valleys of post-Glacial origin, of which the Wansbeck is a good example, are narrow and gorge-like where they have been denuded through rock, and are thus clearly differentiated from those of the earlier epoch, whose sides slope down gently to the "thalweg." The latter bear evidence to the protracted action of the forces of sub-aërial denudation, while the former have been carved rapidly, and atmospheric and other agents of surface waste have not broadened and widened them to any considerable extent. The valleys of the two cycles are distinct, and the outlets of the rivers flowing in them are also quite different in character; thus the mouths of the superimposed valleys of the Tyne and Tees are broad, and have a wide area of flat land on either side of them, while those of the post-Glacial rivers of the Wear and Wansbeck are narrow. This has had a considerable influence on the commercial development of these rivers. The premier position of the Tyne depends on the fact that it flows in a superimposed valley; thus its haughs, on which its towns, villages, and shipyards are built, are broad, and extend for miles along its entire lower course, while its mouth is wide and of easy approach. The haughs of the Wear do not reach to its narrow mouth, and its sides rise steeply from the waterway.

The geographical position and commercial importance of Newcastle is due to the broad, flat, superimposed valleys of the Tyne, Derwent, and Team converging there. It is also of easy access from the boulder clay flats of Cleadon and Fulwell. All the railways that enter Newcastle have been constructed without meeting with any important physical barrier—no tunnels and few cuttings have had to be made. The main roads running from that city are also of easy gradient, with the exception of those that climb the northern and southern flanks of the preglacial rock-surface. On the other hand, the railways that enter Sunderland have met with physical obstacles due to the position of the Permian escarpment and the later development of the Wear valley. They have all had to pass through cuttings or tunnels.

Another important effect of the Glacial period was that nearly the whole of the country was clothed in a mantle of drift, which has rendered the dependence of the drainage upon the geological structure much less pronounced to-day than it was before the era of glaciation. The surface deposits lie thickest along the ancient "washes," reaching a maximum proved thickness of 230 feet at Newton Hall, Framwellgate, 2 miles north of Durham city, in the valley of the Wear. On the higher ground some of the escarpments rise like islands from beneath the cloak of superficial deposits, and in Northumberland especially, on account of the ease with which water could be obtained at these places, this has had considerable influence in determining the position of the minor places of settlement. Many of the villages of Northumberland

Reduced Geological Survey Drift Map showing the masses of sandstone (black) rising above the drift. The villages of Earsdon, Backworth, Killingworth, Whitley, &c., are built on such outcrops.

Nat. Scale 1:100,000 or 1 inch = 1.58 Stat. Miles.

1 0 1 2 3 4

Fig. 1. Section across one of the outcrops of sandstone which rise above the drift. The earliest settlements in Eastern Northumberland were built on such, due to the ease with which water could be obtained at the junction of the sandstone and drift.

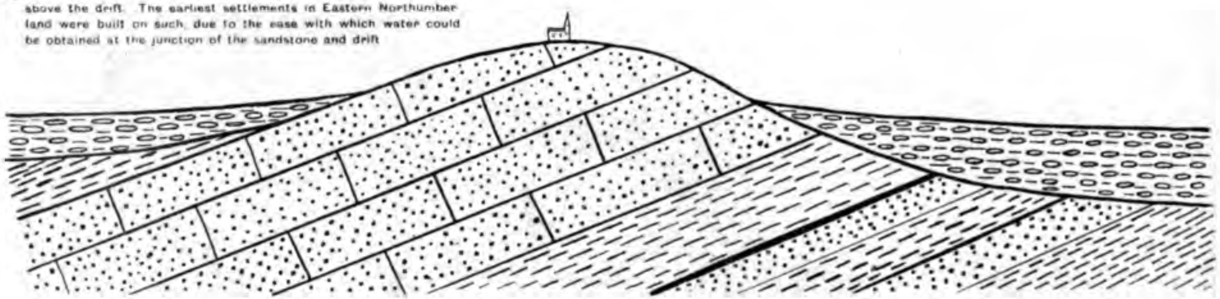
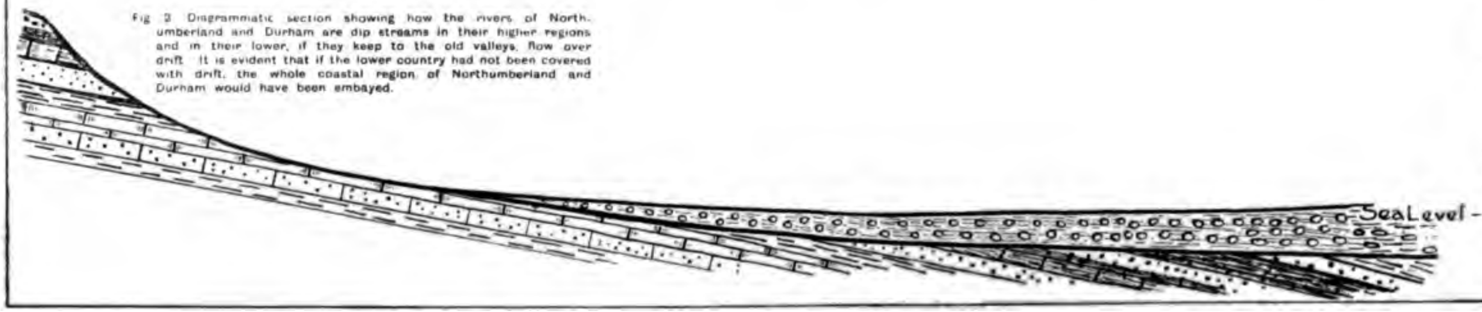


Fig. 2. Diagrammatic section showing how the rivers of Northumberland and Durham are dip streams in their higher regions and in their lower, if they keep to the old valleys, flow over drift. It is evident that if the lower country had not been covered with drift, the whole coastal region, of Northumberland and Durham would have been embayed.



WHITBURN BAY.
(*H. Mitchell, photo.*)

(especially those with the syllable "ing" in their names) are, as Topley pointed out many years ago, old settlements, and either stand on sand and gravel hillocks lying on the boulder clay, or on exposures of sandstone which rise above the uniform level of the surface formations. A large number of the pit villages, which are in many cases merely enlargements of the ancient settlements, belong to the latter class, *e.g.* Killingworth, Widdrington, and Earsdon. The sandstone outcrops are doubtless escarpments, whose features are to a very large extent masked. Over the whole of the two north-eastern counties parts of, and in some cases, entire escarpments lie buried beneath the drift, and doubtless many minor valleys of the earlier epoch are entirely filled up and obliterated as surface features.

Where the pre-Glacial valleys debouch into the sea, the boulder clay which fills them has been denuded more quickly than the rock on either side, and in consequence many wide sweeping sandy bays have been formed. The principal are Druridge and Whitburn Bays, and those at the mouths of the Tyne and the Tees. They form a distinct feature of the north-eastern coast.

An influential factor in the development of the physiographical features of the two northern counties was the submergence of the eastern coast to a depth of at least 150 feet. Raised beaches reaching this maximum elevation have been observed and traced for many miles

in Northumberland and Durham. They rest in some cases on the rock and in other cases on boulder clay, and are largely formed of materials chiefly derived from the latter deposit, and therefore bear evidence to a submergence of the coastal region since the Ice age. The highest with its associated cliff and sea caves is or has been exposed, at about 150 feet above sea-level on Cleadon, (19) Fulwell, (20) and Tunstall Hills, and in the railway cutting near Dawdon Colliery along the new line between Seaham Harbour and Castle Eden. The next is the 100-feet raised beach running round Cleadon Hills. It is at present exposed in the two gravel and sand pits to the west of Cleadon village, and was exposed in 1878 at the Whitburn Lizards on the eastern side of the same hills; (21) it is observable near Tynemouth, (22) and along the coast to the south of Seaham Harbour as far as Castle Eden Dene. (23) A much lower one is traceable on the top of the cliff north of Howick Burn to the south of Cullernose Point; (24) and 50 miles further south a raised beach occurs near Saltburn at an elevation of 30 feet. (25) There are many peculiarities in these exposures and

150-FEET RAISED BEACH ON FULWELL HILLS, NEAR SUNDERLAND.
(*D. W., photo.*)

their relation to one another, which cannot be discussed in this general paper. The highest two of these raised beaches have been splendidly preserved on the Permian area of County Durham, because the pebbles have been cemented together to form a conglomerate by calcium carbonate derived from the Magnesian Limestone, and it is possible that the reason they cannot be traced very far inland is, that the materials forming them were never cemented, and thus they were unable to withstand subsequent denudation. When the highest beach was being formed, all the lower parts of the eastern area of the two counties were submerged, the lower reaches of the rivers were arms of the sea, and some portions of the higher lands lying near the coast, as

HAWTHORN DENE, A GORGE-LIKE POST-GLACIAL VALLEY CUT SINCE THE FORMATION OF THE RAISED BEACHES.
(*D. W., photo.*)

Cleadon Hills, were islands. It was probably during this period that the upper parts of the boulder clay lying on the lower ground were washed up and redeposited, the prismatic clay—the brick clay of the coastal area—being produced by the drying up of the saturated deposits. All traces of the ridges and mounds, which form such a distinct feature of the boulder clay in other areas, and which probably existed on the lower parts of Northumberland and Durham, as they do still on the higher, were removed, and the whole of the region lying along the coast was levelled out, and the upper parts of the boulder clay rendered less stiff. This submergence has had a considerable influence on the commercial development of the district, and the subsequent elevation of

the land, by giving new power to the forces of sub-aërial denudation, has had a marked effect on the physical features of the two north-eastern counties. It has been already shown that the present rivers of these counties are post-Glacial in origin; they have either superimposed valleys on the ancient pre-Glacial valleys, or are cutting entirely new courses, which in their lower reaches have been developed since the uplift that produced the raised beaches.

This recent period of denudation has had most effect on the triangular portion of the country lying between the edge of the Permian outcrop and the sea, the entire rock surface of which is composed of Magnesian Limestone. The escarpment rises sharply from the level country to the west, reaching a height of from 400 to 600 feet, and from it the land slopes gently to the 100-foot cliff of the Durham coast. Before the Glacial period this district had been carved by numerous small streams, which, when the district was more elevated, were all tributaries of the pre-Glacial Tees. As the steep but not very elevated escarpment seems to have acted as a barrier to the iceflow from the west and north-west, this country is not very thickly covered with drift, and hence many of the earlier-formed valleys—called in some cases "hopes," as Tunstall Hope—although now dry, form a distinct feature of the surface of east Durham. Since the formation of the raised beaches and the associated marine terrace, which are clearly observable on the Durham coast south of Seaham Harbour, the country has had a new drainage superimposed on the old, and many deep, gorge-like valleys—designated "denes," as Ryhope, Hawthorn, and Castle Eden Denes—have been eroded.

Along the coast of Northumberland and Durham submerged forests have been observed at North Sunderland, Howick Burn, Whitburn Bay, and Hartlepool, (26) and these seem to mark a slight recent submergence of the coastal region; but the effect of this in hindering the development of the streams of the recent period must have been exceedingly slight. Whether this movement is at present taking place in the area, it is impossible to assert; and although certain parts of the district appear to be sinking slightly—as was proved by T. W. Backhouse and Frank Caws to be the case in the neighbourhood of Sunderland (27)—such a lowering may be due to other causes than a general depression of north-east England.

Finally, it is certain that the present topography of Northumberland and Durham has been evolved gradually; the reproductive and destructive forces have, by their protracted action, produced the present configuration of Northumbria; and the results of these have influenced the commercial development, determined the position of the towns and villages, and regulated the lines of human movement within this clearly defined physiographical area.

After the paper:—

Dr. STRAHAN: I should like to say, in the first place, that although much of what Dr. Woolacott has put before us this afternoon is familiar to us from his paper in the *Quarterly Journal* of the Geological Society, it has been a great pleasure to hear his application of that information and its influence upon the situation of the towns brought out so clearly. Probably no one is better aware than Dr. Woolacott himself that such phenomena are not confined to this part of England. It is evident that the country, when freed from its great ice-burden, did not resume the same aspect which it had before. In many parts the rivers assumed different courses, and the physical features were greatly changed. The Mersey, for example, has been proved to be running in a post-Glacial channel, diverging from that which it occupied in pre-Glacial times. Just as these Durham rivers were filled up with drift, so were the former channels of the Mersey. The Tawe also, at Swansea, flows over a thickness of more than 150 feet of gravel; and so with many other rivers which I could enumerate. But further south it is possible to see what these valleys would have been like if they had not been choked up in this manner with gravel. Milford Haven, Plymouth Sound, and other branches of the sea wander far inland and enable the tide to penetrate into districts where the stranger would least expect to find it. One remark Dr. Woolacott made interested me greatly. He spoke of a small anticlinal fold—the Corbridge—as having determined the courses of certain rivers, and he also spoke of the courses of those rivers as having been determined in pre-Miocene times. Now, the evidence is clear that all our south country rivers have had their courses determined at a much later period than that. The sinking of the London syncline and the upheaval of the Wealden anticline, the sinking of the Hampshire syncline and the upheaval of the Isle of Wight anticline, directly determined the flow of those rivers. But in the Isle of Wight it is easy to determine the exact geological date at which those folds came into existence; they were certainly post-Oligocene, inasmuch as the Oligocene strata are involved in the folding, but they were certainly pre-Pliocene, inasmuch as the anticlines were upheaved before the Pliocene strata were spread over them. It follows that the river-system of the south country was initiated in post-Oligocene and pre-Pliocene times. I endeavoured, some years ago, to extend that theory into the south-west region, but in the absence of all Tertiary strata and of the chalk, it is exceedingly difficult to apply the test; in fact, it cannot be applied directly. I did not meet with any evidence bearing against the theory that the rivers, say, of South Wales and Devonshire, might have taken their origin at an equally late period, but I was unable to obtain confirmation of it. If Dr. Woolacott can throw any light on that problem, and show that the rivers of Northumberland and Durham were initiated by earth-folds at so late a period as those of the south country, he will have added a very interesting fact to the history of our English rivers. One point I should like to mention, and I am afraid it rather takes the form of criticism. Dr. Woolacott showed us some photographs of what he calls "raised beaches." I should like to know what was the evidence on which those deposits of sand and clay were classed as raised beaches. Of course I only judge from the photographs, but what I saw in them resembled so exactly the deposits of sand, gravel, and boulder clay with which I am familiar in many parts of England, and which are indubitably Glacial and not raised beach, that I should like to ask what is the evidence that it was actually the sea which formed the deposits to which he referred. Before sitting down I wish to congratulate Dr. Woolacott on the lucidity with which he has put before us a somewhat technical subject.

Mr. LAMPLUGH: Dr. Strahan has already raised the main question that I should

like to put to Dr. Woolacott, namely, What is the evidence on which he depends in recognizing the high-level terraces as marine beaches? I have myself examined the coast from the Humber to the Tees, for the purpose of determining whether there has been submergence during or since glacial times, and could find no evidence for it. The so-called beach at Saltburn at 30 feet above sea-level, to which Dr. Woolacott refers, is in such a position that it is quite unlikely to be a post-glacial sea-margin. A depression of the kind supposed would have submerged a large part of the Tees valley, and also many wide areas of low land farther south in East Yorkshire, yet in these places there is no sign of marine agency at this level since the deposition of the drift. It is true that there are fringes of sand and gravel deposited by water in this country, but these were probably all accumulated at the margin of the ice-sheet, or in bodies of fresh water pent in between the ice-sheet and the land. If there has been a post-glacial submergence to the extent of 150 feet in the area described by Dr. Woolacott, the absence of evidence for any such submergence south of the Tees raises a very important problem. Therefore, unless the evidence is very clear, the author should be especially cautious in speaking of gravels and clays as marine, since much depends upon it.

With regard to the evolution of valleys, a question in which geographers and geologists join hands, the geologist usually finds it comparatively easy to picture to himself the pre-glacial valley-system, even where it has been greatly modified, as in the present case, by masses of drift; but when he goes back into Tertiary times, then he goes into the region of speculation and doubt. We have, in fact, no good basis yet for appreciating how much re-shaping of the land has taken place since, say, early Miocene times. The attempt to trace the earlier history of the East Yorkshire valleys, to which reference has been made by Dr. Woolacott, is regarded, by those who know the country, as so highly hypothetical that it scarcely requires consideration. If we at present concentrate attention upon the pre-glacial topography in any district, we shall, I think, do better than if we attempt immediately to carry back our ideas of the ancient topography so far that all is involved in mist and hypothesis. I feel this the more keenly because so fully in sympathy with the renewed interest now aroused in these studies, that I should be sorry to see the subject discredited by any hasty and premature theorizing. We shall in time get a surer grip of these problems, and can afford to be patient. Therefore I would ask Dr. Woolacott, who has made such an excellent beginning in these studies, to go warily when he gets away from his pre-glacial valleys and deals with the shape of the land in Miocene times.

Mr. Mackinder: I need hardly say that I have listened to this paper with a great sense of congratulation to the writer, but naturally from a slightly different point of view from that taken by the two gentlemen who have already spoken. They are experts as to the geological evidence, and I am looking rather to the geographical application of the evidence established. What I would venture to say at the present moment is something connected with the first paragraph of this paper, because method in geography is just now of some importance. Of course, for purposes of investigation you cannot cut a subject sharply into parts, nor can you divide one subject abruptly from another. For the purposes of investigation the limits of subjects are immaterial. But from the point of view of academic study, these matters of organization have a certain significance. At the present moment in various universities syllabuses of geographical study are being settled, and they will determine in no small degree the fate of the present effort to give to geographical education a university status. Now, I notice that Dr. Woolacott divides the joint material of geology and geography into two sections. I would venture to suggest, as a general guidance for the drafting of these syllabuses,

that a division into three of that joint material would be better. I may cite, as supporting my view, the well-known statement in Sir Archibald Geikie's 'Text-book of Geology' that geology divides naturally into the study of the history of the rocks, and the study of the history of the present surface. To these two divisions must be added as a third what stands as Dr. Woolacott's second division, namely, the application to the problems of human distribution. It is, of course, quite true that when you come to the glacial epoch in such a country as ours, sharpness of definition between the first and second divisions is no longer possible, and I suppose that the geographer, no less than the geologist, must consider both the pre-glacial surface and the present surface. But with that slight blur on the sharpness of definition, and with every admission that the definition must not be pressed too far, I think that for the purpose of classification and for the drafting of syllabuses which are to guide study, the triple division to which I have referred is important. The second division is common ground to the geologist and the geographer. But you will not get the geographical student who approaches geography with a view to its humane applications to give much study to the first. Unless you detach it, there is great danger that he will jettison also the second, and this would be fatal to any sound knowledge of those physical features on which humane geography is based. Such a paper as we have had to-day is of the greatest value, because it discusses a limited district thoroughly from the point of view of the features of the present surface.

When Dr. Woolacott came to his applications of these physical facts, one felt, of course, that he was considering only one set of the causes which the geographer must take into account. For instance, he described Newcastle-on-Tyne as being placed at the junction of certain valleys of a certain character, and then he contrasted it with the position of Sunderland. Then he went on to point out that the railways had access to Newcastle more easily than to Sunderland as the consequence of these facts. But, of course, this would not account for the greater significance of Newcastle, since both that town and Sunderland existed before the railways, and the railways were made to these towns just because they did already exist. The towns rose as market centres, dependent on the productivity of the areas around, and larger considerations determining the lie of the roads from distant centres account for the greater importance of Newcastle than Sunderland. I do not for a moment suppose that Dr. Woolacott intended to exhaust the causes, and I merely wish to point out that there are other great groups of causes to be considered by the geographer in addition to the geological, as, for instance, the economic and strategic. What we require at the present moment is that persons who are equipped from the geological point of view like Dr. Woolacott should go on to equip themselves from the historical point of view, and then should give us, as I feel sure he could most admirably, the complete geographical picture of some such region as he has considered. I am convinced, from all that I have now had to do with geographical study, that two men working together will never satisfactorily accomplish these syntheses, and that it is absolutely essential that each district should be treated by one man working with a double equipment.

Mr. Chisholm: There is one thing for which, I think, we must feel indebted to Dr. Woolacott, and that is, that in considering the region dealt with this afternoon, he has given us an account of the recent geology. For the most part, geological maps and geological treatises consider merely what they call the solid geology, and very often the solid geology is just that part which leaves out of account what is of most interest to geographers. I remember, as an illustration of that, that when I was taking a holiday I thought it would add to the interest of my holiday to get a geological map of the district, and, having obtained the proper sheet of the geological

map on the scale of 4 miles to the inch, I was talking to a resident, and said, "Now, this village stands upon chalk." "Excuse me, sir," he said; "it stands upon gravel." On looking about me, I found he was right; it did stand upon gravel, and upon a very great thickness of gravel. And what I found was that the geology that actually gave significance to the physical features was the drift, which was altogether omitted from this map. And now I feel tempted to make one or two remarks that have suggested themselves to me in reading this first paragraph of the paper, but which I had not intended to make until Mr. Mackinder touched upon that part of the paper. I thought the distinction between the point of view of the geographer and the geologist was really so large a subject that it was hardly possible to enter upon it in an afternoon meeting like this, but, as the question has been raised, I feel disposed to make some remarks upon it. On this subject I am, to a large extent, but not wholly at one with Mr. Mackinder. It seems to me that there is a very clear, sharp, and absolutely decisive line of division between geology and geography, a line of division not determining the difference in the subject-matter, but a difference in the point of view. Mr. Mackinder has stated that Sir Archibald Geikie makes a twofold division of the subject-matter, but it is also to be noted that he also gives a definition of geology which makes the aim and nature of the geologist's inquiry perfectly clear. Sir Archibald Geikie states that geology is the science which inquires into the history of the Earth's crust. Well, that is very clear, and if that is the aim of geology, every investigation that deals with the history of the Earth's crust, even if it be the very latest changes that have taken place in the course of a river, belongs to the sphere of geology. In his opening paragraph, Dr. Woolacott says that the bearing on humanity of the Earth's crust, its places of settlement and lines of movement, is chiefly the work of the geographer. Now, though I would not admit that the consideration merely of the geological structure upon human life forms the entire field of the geographer, yet I can accept this statement as at least indicating the function of the geographer. The geographer as is here indicated considers effects. The study of the geographer is the study of the influence of local conditions and place relations, and I think, in giving that definition, I have included everything Mr. Mackinder has just indicated as among the matters that had been—I won't say overlooked—but passed over by Dr. Woolacott in considering the geographical influences on the part of England that we have been studying this afternoon. Mr. Mackinder said that, in addition to a precise, minute local study, we must take also a broad view. Well, that is what I mean by describing geography as including the study of place relations. These are included under a broad view of the study of any particular place, such as Newcastle or Sunderland; and then, taking that broad view, we must bear in mind the fact that influence of place relations varies at different times. To give an illustration of points of some little interest in connection with the geography of Northumberland that might have suggested themselves to Dr. Woolacott had he not confined himself solely to the inflence of geological conditions, I might refer to a valley in Northumberland that has been a great highway for a very much longer period than one of the routes to which he has referred in his paper. He spoke of the railway going from the Tyne valley into Scotland and then up Liddisdale. That is quite a new route. The old Roman road, and the road which was afterwards so important through a long period of Scottish history, went over a broader part of the Cheviots. Now, the difference in the line of these two routes is a matter of some little geographical interest. There are parallels to it in various parts of the world, but parallels that are altogether independent of geology. The interest connected with this difference, from the geographical point of view, is this—that the old road before the days of railways naturally took the easiest gradient up to the most convenient

part to be crossed, and then went downwards by an equally easy gradient on the other side, if it could get that easy gradient. The result of that is that a broad part of the mountains and hills to be crossed was naturally chosen, but railways may run for a long distance into the hills by valleys with still easier grades, and ultimately come to a narrower part of the hills where a tunnel can be made. That is what we have in the present railway route of the Mont Cenis tunnel as compared with the old Mont Cenis road; in the first railway route between Genoa and the northern plains of Italy as compared with the route over the Bocchetta pass; and in the railway route between Bologna and Florence as compared with the old road across the pass of La Futa, and in other cases. But these things I mention solely by way of illustrating what I understand to be the distinction between the geologist's and the geographer's point of view, fully recognizing that they did not fall within the scope of Dr. Woolacott's paper, as to the value and interest of which I am quite at one with the previous speakers.

The CHAIRMAN: Would any other gentleman wish to join the discussion? If not, perhaps Dr. Woolacott will reply briefly to the points that have been raised.

Dr. WOOLACOTT: Allow me, first of all, to thank you for the discussion. The paper was never meant to be an exhaustive study of the geography of the two counties; it was simply an idea of mine to give a physiographical basis to the geography of the counties. With reference to Dr. Strahan's remarks, I do not think it is possible to fix the time, so far as one can gather from any of the features exposed, of the Corbridge Fold. With regard to the raised beaches, I may say they have been recognized from at least 1878. Sea-caves were found at the time of the first exposure, and there is an old sea-cliff found at the present time. The sea-caves were distinctly cut out, and several animal remains were found in them. Shells occur in the gravels, although I have never found any perfect ones, but they have been, and I have found several fragmentary portions similar to those found at the present day. Numerous specimens of *Patella*, *Littorina*, and *Cyprina* have been collected.

Mr. LAMPLUGH: Mr. Cowper Reed described a gravel with shells in it.

Mr. WOOLACOTT: I am quite aware of that. I also know there are glacial gravels at a higher level, covering certain portions of Durham and Northumberland, but the line of these marine gravels can be distinctly traced for some miles along the coast. The rocks on which they rest appear to be distinctly water-worn, and there is a marine terrace running for some distance along the coast. I think most of the geologists of the north of England, the local workers at any rate, have recognized these raised beaches. All I have done is to endeavour to trace them from one point to another. I quite agree with you that it is a most important matter; but there is one point that is rather in favour of their being raised beaches, and that is, that there is a distinct change in the character of the country above the 150-feet contour-line; beneath it the drift is quite level, while above, the ridges and mounds are still preserved.

Mr. LAMPLUGH: That is so also with glacial drift deposited in lakes or currents of fresh water. Have you been able to find the beach farther south?

Dr. WOOLACOTT: I do not know of it further south. Between the Tees and Flamborough, it may have been removed by denudation. The Geological Survey recognized these raised beaches. I may say the only reason I mentioned the course of the Tees across the Cleveland hills was in order to make the paper as complete as possible. I do not recognize that there is any evidence proving the Wear to have been a tributary of the Tees. Of course, one must take into account the work of other workers. I think I have answered Mr. Mackinder and Mr. Chisholm regarding my idea of the paper, that it was simply looking at geography

from the physiographical standpoint, being an endeavour to show how certain features of Northumberland and Durham had influenced the commercial development and fixed the places of settlement. A "wash" is simply a valley of preglacial development now filled with drift. "Slack" is either a dry valley, or a valley in which there is a small stream which could not have caused the valley—a stream which is not adjusted to the valley, and in Northumberland and Durham have been caused in several ways. "Haugh" I regard as the river flats. In conclusion, I desire to thank you for your attention and for your criticisms.

The CHAIRMAN (Major C. F. CLOSE): I am afraid I can add nothing to the discussion to-night, the subject being rather too technical for me to follow with advantage. But I may say that I have derived as much instruction from the discussion (which I consider to be one of the best we have ever had) as from the very carefully prepared and well-illustrated paper of Dr. Woolacott. I will ask you to join me in a cordial vote of thanks to him for the trouble he has taken and the instruction he has given us.

Dr. HERBERTSON, who had to leave before the close of the discussion, made the following communication:—

He thought that it was part of the work of the Research Department to secure such papers as this, in which Dr. Woolacott gave a general summary of his own researches and those of other geologists on the evolution of a definite region. He was very much impressed with the clear way in which the facts and explanations had been presented, and by the admirable diagrams and views which had been thrown on the screen, most of which he hoped would appear when the paper was published in the *Journal.*

He agreed with Mr. Lamplugh's contention that the most satisfactory way of tracing the evolution of present land forms was to pass step by step from the present into the past rather than the other way. He also advocated a much more general use of the comparative method—the selection of examples of stages of development as they are best seen in different and maybe widely severed districts which are comparable in structure and in climate.

Dr. Woolacott had paved the way for a rational geographical treatment of the morphology of Northumberland and Durham; he had prepared the raw material in such a way that the geographer could use it. But it was necessary to point out, as Mr. Mackinder and Mr. Chisholm had done, that the function of the geographer was more than to trace the influence of configuration on mankind. After their remarks, he need only add that he hoped that Dr. Woolacott himself might take up the study of the geography of this north-eastern region of England, and give them at no distant date the results of his investigations.

There was another point in the printed paper to which he would like to refer—viz. the suggestion that swire or swyre should be used as a technical term for all dry valleys. At the present, when terminology was not yet fixed, it was highly desirable that definite rules should be adopted. As far as possible, terms for the larger classes of geographical phenomena should be selected so as to be sufficiently intelligible to the ordinary person, while conveying precise ideas to the specialist. For the subdivisions, which were of interest mainly to the specialist, this was not so important, yet even here intelligibility should be considered. Hence he would prefer to use the term "dry valley" for the general class, and such terms as "slack, swyre, bottom," etc., for the varieties of dry valleys.

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BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND.*

Under the Direction of Sir JOHN MURRAY, K.C.B., F.R.S., D.Sc., etc., and LAURENCE PULLAR, F.R.S.E.

Part XIII.—Lochs of the Ness Basin.

FIRST PART.

The basin of the river Ness is one of the most important of Scottish river-basins, not so much on account of the area drained, which is small when compared with the areas drained by the Tay, Tweed, Clyde, and Spey, for instance, but because it includes within its boundaries the largest body of fresh water in Scotland (Loch Ness), as well as several other large lochs and numerous small ones. The basin extends from the mouth of the river Ness, at the junction of the inner Moray Firth with the Beauly Firth, in lat. 57° 30′ N. to lat. 57° N., south of Loch Quoich, and from long. 5° 30′ W., west of Loch Quoich, to long. 4° 10′ W., south-east of Inverness. The total area, as measured with the planimeter on the 1-inch Ordnance Survey maps, is about 722 square miles, and of this by far the larger portion drains into Loch Ness, for the area draining into the river Ness, and into Loch Ashie which flows directly

* Maps, p. 116. The admirable maps which accompany the present and two succeeding papers (the last of the series) have been presented by Sir John Murray and Mr. Laurence Pullar, and it is thus due to their liberality that we are able to publish them free of any cost to the Society.—President R.G.S.

into the river Ness, is only about 36 square miles. With the exception of Loch Ashie, the superfluent waters from all the lochs within the basin find their way into Loch Ness, so that the total area draining into Loch Ness is about 686 square miles. The area drained by the tributary lochs, to be dealt with in subsequent papers, is about 354 square miles, leaving about 332 square miles draining directly into Loch Ness, independent of the other lochs.

The principal river-systems within the basin lie to the west of Loch Ness, viz. the Enrick, which flows through Glen Urquhart into Loch

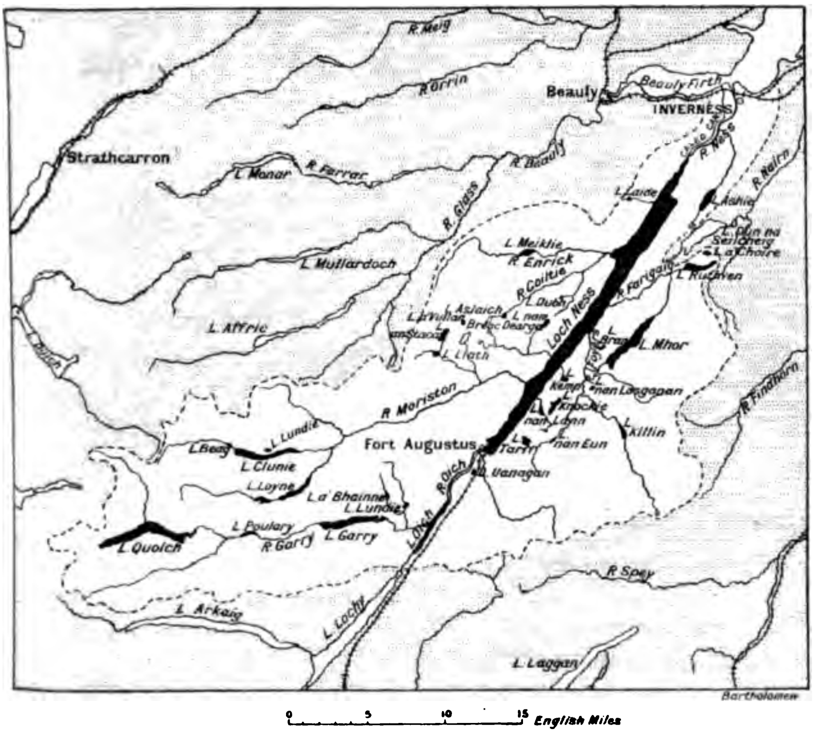

FIG. 1.--INDEX MAP OF THE NESS BASIN.

Ness at Urquhart Bay, where it is joined by the shorter river Coiltie; the Moriston, with its tributaries the Clunie and the Loyne, which flows through Glen Moriston into Loch Ness at Invermoriston; the Garry, with its tributaries the Quoich and the Kingie, which flows through Glen Garry into Loch Oich at Invergarry, and thence by the Oich into the head of Loch Ness at Fort Augustus. To the south of Loch Ness lies the Tarff, also entering Loch Ness near Fort Augustus; and to the east lie the Foyers, with its tributaries the Breinag and the Fechlin, which flows into Loch Ness at Foyers, and the Farigaig which

enters Loch Ness at Inverfarigaig. Finally, to the north-east of Loch Ness lies the Allt Mor (or Big Burn), draining Loch Ashie, which flows into the river Ness 2 or 3 miles below Inverness, while the river Ness, after issuing from Loch Dochfour, at the northern end of Loch Ness, follows a winding course of about 6 miles, and pours its waters into the Moray Firth. Besides these, there are many shorter streams and burns flowing directly into Loch Ness, or into the tributary rivers or lochs.

As will be seen from the summary table, the staff of the Lake Survey sounded thirty-three lochs within the Ness basin, while a number of small lochs could not be surveyed for lack of facilities. These lochs vary in size, from the little Loch nan Losganan, covering an area of only 7 acres, and containing only a million cubic feet of water, to the mighty Loch Ness covering an area exceeding 20 square miles, and containing many thousands of millions of cubic feet of water. None of the other lochs in the basin can be compared with Loch Ness, neither as regards area, volume, nor depth, but still a few of the lochs are of considerable importance. For instance, Loch Quoich is 7 miles in length, while Loch Garry and Loch Mhor are nearly 5 miles in length, and Loch Clunie and Loch Oich exceed 4 miles in length. Loch Quoich, again, covers an area of nearly 3 square miles, while Lochs Garry, Mhor, and Clunie exceed a square mile in area. Two of the lochs (Quoich and Garry) exceed 200 feet in depth, and three other lochs (Oich, Clunie, and nan Lann) exceed 100 feet in depth, while no fewer than twelve others include depths exceeding 50 feet.

The basin lies almost entirely in Inverness-shire, but a small portion of Ross-shire extends within the basin on its western border, the boundary-line running along the centre of West Loch Loyne and for a short distance along the centre of East Loch Loyne, and thence turning northward it crosses Loch Clunie in its central part; thus Lochs Loyne and Clunie lie partly in Ross-shire and partly in Inverness-shire, while the little Loch Beag, at the west end of Loch Clunie, is the only one lying wholly in Ross-shire. The scenery of the basin is varied, and as fine as anything to be seen in the Scottish highlands: towards the north the ground is low, but proceeding southwards it becomes more elevated, culminating on the south-western borders in several giant peaks exceeding 3000 feet in height, and on the south-eastern borders in mountains slightly less elevated. The district is a veritable sportsman's paradise, the deer-forests, grouse-moors, and fishings (both in river and loch) being of the best. Trout abound in nearly every loch, with salmon and *salmo ferox* in some of the larger lochs, and char in some of the smaller lochs lying to the east of Loch Ness; the fishing in most of the lochs is preserved.

Loch Ness (see Plates I. and II.).—Loch Ness formed the subject of discussion at a meeting of the Research Department of the Royal Geographical Society on January 18, 1904, and preliminary notes on the bathymetry, temperatures, and seiches were published in the *Journal* in

October, 1904.* Since then many temperature and seiche observations and supplementary soundings have been taken, and the preliminary measurements and calculations have been carefully revised, the final results being given in this paper. Loch Ness is one of the best known of the larger Scottish lochs, since it forms a considerable part (nearly one-half) of the waterway known as the Caledonian canal, which occupies the great glen running in a north-east and south-west direction from the Moray Firth on the east coast of Scotland to Loch Linnhe on the west coast, thus cutting Scotland into two portions. Through the Caledonian canal thousands of visitors are carried each season on the

FIG. 2.—GENERAL VIEW OF LOCH NESS FROM BORLUM, NEAR FORT AUGUSTUS, LOOKING NORTH-EAST.

(Photo by Mr. G. West. From 'Proc. Roy. Soc. Edin.,' by permission of the Council.)

route between Inverness and Fort William, and the splendid scenery of the canal and surrounding district has furnished a theme for many pens. The absence of islands in Loch Ness is a striking characteristic, and gives a touch of monotony to the grand and sombre scene, as one sails up or down; the little Cherry island, lying at the opening of Inchnacardoch bay near the head of the loch, is invisible except at close quarters. Castle Urquhart, on its rocky headland at the south side of Urquhart bay, forms a picturesque and noteworthy landmark.

In his journey to the Western islands of Scotland in the autumn of 1773, Dr. Johnston travelled along the shores of Loch Ness, which, he

* *Geogr. Journ.*, vol. **24**, p. 429.

says, is in some places 140 fathoms deep, and he remarks further that "Natural philosophy is now one of the favourite studies of the Scottish nation, and Loch Ness well deserves to be diligently examined." After the lapse of 130 years this has been done, and it is proposed in this place to summarize the results obtained by the staff of the Lake Survey during their prolonged and "diligent examination" of Loch Ness.

The survey of Loch Ness was commenced on April 2, 1903, and by the end of that month the preliminary survey was completed, but subsequently, at various periods during the years 1903 and 1904, many additional lines of soundings and numerous isolated soundings were taken, some of them in connection with the work of collecting samples of the deposits from all parts of the loch, others in connection with the work of taking temperatures at various depths in different parts of the loch. The total number of soundings recorded is about 1700, but some of them have been omitted on the accompanying map to avoid overcrowding. On April 1, 1903, the level of the surface of the loch was determined from bench-marks as being 52·6 feet above the sea, and to this datum-level all soundings have been reduced. A levelling-staff was erected first at Fort Augustus, then at Invermoriston, Foyers, and Temple piers, and the height of the water on this staff was read daily during the progress of the survey, so that the variations in level from day to day, and the variations from the starting-point, were readily known. These staff readings showed that the water fell gradually but irregularly, and by April 15 it was 1 foot lower, and by the 18th it was 1½ feet lower, than on April 1.

Loch Ness proper may be said to extend from the head of the loch at Fort Augustus to the narrows at Bona ferry, a distance of 22¾ miles following the axis of maximum depth. This figure is inferior to the length of Loch Awe (25½ miles), and slightly in excess of the length of Loch Lomond (22⅗ miles); if we regard the small basin of Loch Dochfour, which is continuous with Loch Ness at its northern end, as forming part of the loch, then the total length, from the exit of the river Ness to the head of the loch, is about 24¼ miles.

In this place it is proposed to include Loch Dochfour in dealing with Loch Ness; it is a basin about 1½ miles in length, with a maximum depth of 50 feet in the wide central portion, whence it narrows towards the two ends, the southern narrows leading into Loch Ness, and the northern termination being divided into two branches, the eastern branch forming the river Ness, and the western branch the continuation of the canal. With a strong south-westerly wind there is a surface current from Loch Ness into Loch Dochfour through the narrows at Bona ferry, and, if long continued, the water becomes banked up in Loch Dochfour, and gives rise to a return current along the bottom into Loch Ness; with a strong wind from the north-east the surface current sets in the opposite direction, *i.e.* from Loch Dochfour into Loch Ness.

Cut off from the western margin of Loch Dochfour, by embankments carrying the towing-path for the canal, are two small basins, one called Abban water, having a maximum depth of 9 feet, the other without a distinctive name, having a maximum depth of 23 feet; they stand at the same level as Loch Dochfour, the water evidently percolating through the embankments.

Loch Ness may be said to be fairly uniform in breadth, though varying to some extent, but on the whole its shore-line is very regular when compared with other large lochs. The upper portion between Fort Augustus and Foyers for about 10 miles is under a mile in width,

FIG. 3.—INCHNACARDOCH BAY, LOCH NESS, SHOWING CHERRY ISLAND AND THE "HORSESHOE" IN THE DISTANCE.

(*Photo by Mr. G. West. From 'Proc. Roy. Soc. Edin.,' by permission of the Council.*)

except at the opening of Glen Moriston, where the breadth slightly exceeds a mile. The portion between Foyers and Castle Urquhart for about 5 miles is almost exactly a mile in width, while the lower portion between Castle Urquhart and Torr point for about 5 miles exceeds a mile in width. The widest part of the loch is at Urquhart bay, from the mouth of the river Enrick due east to the opposite shore, where the width is 2 miles. The portion of the loch from Torr point to Bona ferry for about $1\frac{1}{2}$ miles varies in width from a half to a quarter of a mile, and the central portion of Loch Dochfour is about a quarter of a mile in width. The mean breadth of the entire loch is nine-tenths of a mile, or less than 4 per cent. of the length; a smaller percentage of

mean breadth to length has been recorded only in Loch Shiel and Loch Shin, with 2½ and 3 per cent. respectively.

The waters of Loch Ness cover an area of nearly 14,000 acres, or 21¾ square miles. Among the Scottish fresh-water lochs this is exceeded only by Loch Lomond, which has a superficial area of nearly 27½ square miles. As already stated, the area draining directly into Loch Ness is about 332 square miles, while its total drainage area, including the area draining into all the tributary lochs, is about 686 square miles—an area over thirty times greater than that of the loch.

The maximum depth observed by the Lake Survey staff in Loch Ness was 754 feet, about a mile due south of Castle Urquhart in the centre of the loch. A greater depth than this has been recorded in only one Scottish loch, viz. Loch Morar, which has a maximum depth of 1017 feet, and after Loch Ness come Loch Lomond and Loch Lochy, with maxima of 623 and 531 feet respectively.

The volume of water contained in Loch Ness is estimated at 263,000 millions of cubic feet, or 1¾ cubic miles. In no other Scottish loch does the bulk of water amount to a cubic mile, in fact Loch Ness contains about three times as much water as the two lochs which most nearly approach it in this respect, viz. Loch Lomond with 92,800 million cubic feet, and Loch Morar with 81,500 million cubic feet. The largest volume of water recorded by Dr. Mill among the lakes of the Cumberland district is only 12,250 million cubic feet. As far as we are aware, the volume of water contained in the large lakes of Ireland has not yet been carefully worked out, but, taking Loch Neagh, for instance, which is said to cover an area of 153 square miles (or seven times greater than the area of Loch Ness), and to have a maximum depth of only 48 feet, a rough calculation will show that the bulk of water in Loch Neagh must be less than that in Loch Ness. It seems quite possible, therefore, that Loch Ness may be the largest body of fresh water, not only in Great Britain, but in the United Kingdom.

Correlated with the enormous volume of water in Loch Ness is the high value of the mean depth, which works out at 433 feet for the entire loch. This far exceeds that of Loch Morar, viz. 284 feet, which comes next in this respect. The mean depth of Loch Ness is equal to 57·4 per cent. of the maximum depth—a higher percentage than has been observed in any other large deep loch, the nearest approach to it being in the case of Loch Avich, with a maximum depth of 188 feet and a mean depth of 98 feet, the percentage being 52·4. It is true that in some shallow flat-bottomed basins the percentage of mean depth to maximum depth exceeds that in Loch Ness; as, for instance, Loch Watten in Caithness (70 per cent.), and Loch Bruadale in Lewis (74 per cent.), but the maximum depths are here only 12 feet and 6 feet respectively. Except for Lochs Ness and Avich, in all the deep Scottish lochs, *i.e.* those having depths exceeding 100 feet, the mean depth is less

than one-half of the maximum depth, the percentage varying from 19·4 in Loch Shiel, and 19·5 in Loch Lomond, to 49·4 in Loch Lungard, and 49·6 in Loch Suanival (Lewis).

It has been stated that the surface of Loch Ness stands about 52 feet above mean sea-level, so that by far the greater portion of its floor falls below the level of the sea.

An inspection of the bathymetrical map of Loch Ness shows (1) the comparative simplicity of the basin ; (2) the steep shore-slope throughout the greater part of the loch; and (3) the large area of the lake-floor covered by very deep water. The 100-feet, 200-feet, 300-feet, 400-feet, and 500-feet contours are continuous, and only the 600-feet and 700-feet contours are interrupted by a shoaling opposite the entrance of the river Foyers, probably due to the deposition of material brought down by that river. This shoaling is covered by 515 to 524 feet of water, and both to the north-east and south-west the bottom sinks to depths exceeding 700 feet.

The 100-feet basin is about 22½ miles in length, the southern extremity approaching to within 100 yards from the shore at the entrance of the river Tarff, and the northern extremity extending into the narrow part of the loch beyond Torr point, approaching to within a quarter of a mile from Bona ferry.

The 200-feet basin is 21⅜ miles in length, approaching to within 150 yards from the Monastery boat-house slip at Fort Augustus, and quite close to the south-western shore off the entrance of the river Oich, and extending beyond Torr point on the north to within less than a mile from Bona ferry.

The 300-feet basin is 20¾ miles in length, extending from less than 300 yards from the Monastery boat-house slip on the south to just beyond Torr point, or 1½ miles from Bona ferry, on the north.

The 400-feet basin is 20 miles in length, distant over a quarter of a mile from the Monastery boat-house slip on the south, and about three-quarters of a mile from Torr point, or over 2 miles from Bona ferry, on the north.

The 500-feet basin is about 18½ miles in length, distant less than a mile from the Monastery boat-house slip on the south, and about 1½ miles from Torr point on the north. The southern extremity of this basin differs somewhat from the usual truncate form, partaking of a rectangular character.

The two 600-feet basins are separated by an interval of little over half a mile, and are almost exactly equal in length, both of them slightly exceeding 8 miles in length. The northern one is distant about 2 miles from Torr point, and the southern one less than 2 miles from the Monastery boat-house slip at Fort Augustus.

The two 700-feet basins are separated by an interval of nearly 2½ miles, the northern one being nearly twice as long as the southern

one, and including the maximum depth of the loch—754 feet. The northern basin is 6⅓ miles in length, and distant about 2¾ miles from Torr point, while the southern basin is 3⅓ miles in length, and nearly 6 miles distant from Fort Augustus. The maximum depth recorded in the southern basin was 739 feet near the southern end of the basin, while towards the northern end of the basin a depth of 735 feet was recorded, the intervening soundings being slightly shallower.

These details show how extremely symmetrical Loch Ness is in all its bathymetrical characteristics. All the contour-lines, except the deepest one, approach rather closer to the southern than to the northern end of the loch, but in the case of the 700-feet contour this is reversed.

The shore-slope on both sides of the loch is nearly everywhere steep. Gradients exceeding 1 in 1 are of frequent occurrence, and in certain places the slope approaches the precipitous. Near the southern end of the loch, off the south-western shore at the entrance of the river Oich, a sounding in 204 feet was taken about 100 feet from shore, but the steepest slopes were observed off the north-eastern shore in the vicinity of the Horseshoe craig, where a sounding in 236 feet was taken about 100 feet from shore; another in 175 feet about 50 feet from shore; and, off what is known as the Cormorant rock, a sounding in 206 feet was taken about 50 feet from shore. This last-mentioned sounding gives a gradient exceeding 4 in 1, or an angle of about 15° from the perpendicular.

The steep shore-slope is further seen by the manner in which the contour-lines of depth as a rule hug the shores, leaving a comparatively very large area of the lake-floor along the central line of the loch covered by very deep water. This is strikingly shown by the fact that nearly one-half of the entire basin is covered by more than 500 feet of water, and over one-third by more than 600 feet of water. In the following table are given the approximate areas in acres between the consecutive contour-lines drawn in at equal intervals of 100 feet, and the percentages to the total area of the loch :—

Feet.	Acres.	Per cent.
0 to 100	1892	13·6
100 „ 200	1340	9·6
200 „ 300	1610	11·6
300 „ 400	1121	8·0
400 „ 500	1329	9·5
500 „ 600	1627	11·7
600 „ 700	2461	17·7
Over 700	2556	18·3
	13,936	100·0

This table brings out several interesting peculiarities when compared with the similar tables published for the other large Scottish lochs. The most remarkable point is that the two deepest zones are larger than any of the other shallower zones, the deepest zone of all,

though the interval between the 700-feet contour and the maximum depth is only half the usual interval between the contour-lines, being the largest of all. Such a distribution of the depth-zones has not been observed in any other loch, and is a reversal of the usual rule of the shallowest zone being the largest one, though one or two exceptions to this rule have been recorded, as, for instance, in Loch Treig, where the zone between 200 and 300 feet is larger than either of the two shallower zones, and in Loch Lochy, where the zone between 100 and 200 feet is a little larger than the shore-zone. In the deepest of all Scottish lochs, Loch Morar, the shore-zone is equal to 42 per cent. of the total area, and the second zone between 100 and 200 feet is equal to 13 per cent., while of the deeper zones not one exceeds 9 per cent. of the total area. In Loch Lomond, again, the shore-zone is equal to 68 per cent. of the entire area, and the second zone between 100 and 200 feet is equal to 16½ per cent., while the deeper zones are in each case less than 6 per cent. In Loch Ericht the shore-zone is equal to 34 per cent., the second zone between 100 and 200 feet is equal to 25 per cent., and the third zone between 200 and 300 feet is equal to 19 per cent. of the total area, the deeper zones in each case not exceeding 10 per cent. In Loch Tay there is a regularly decreasing percentage in the zones of depth from the shore into deep water, the numbers for each zone at intervals of 100 feet being respectively 30, 23½, 21, 15½, 9.

DR. STEIN'S EXPEDITION IN CENTRAL ASIA.*

Since sending you my last news three months ago from Keriya I have covered a good deal of ground on my journey eastward, close on 1290 miles marching distance. Considerations connected with the limited winter season, during which alone excavations are possible at the more distant of old sites in the desert, obliged me to time my arrival in the Lob Nor region by the beginning of December. The effort to combine with this rate of progress thoroughness in the exploration of what ancient remains could be traced *en route* along the southern edge of the Taklamakan has caused no little strain.

My first objective was the ancient site in the desert north of Niva, where in 1901 I had discovered the remains of a settlement abandoned in the latter half of the third century A.D. Want of time and of adequate labour had then prevented me from clearing some of the ruins more deeply buried by drift sand; subsequent roamings of "treasure-seekers" had led to the discovery of other homesteads hidden away among the high sand-cones on either side of the main groups. Working with as large a party of labourers as I could keep supplied with water from a

* Communication from Dr. M. A. Stein.

distance of some 20 miles, I cleared now close on thirty more dwellings. They yielded ample antiquarian spoil, including many implements and household objects illustrative of everyday life seventeen centuries ago. The numerous relics of industrial art and architectural wood-carving clearly reflect the predominant influence of Græco-Buddhist art as developed on the Indus. Finds of records, written on wooden tablets, in the Kharoshthi script peculiar to the extreme north-west of India, and in an early Indian dialect mixed with a good deal of Sanskrit, have been abundant. Among these records, generally in excellent preservation, all kinds of correspondence, official and private, deeds, accounts, etc., seem to be represented. A "haul" of special importance was secured in the comfortable residence of a local official, who, besides leaving files of papers, *i.e.* tablets, scattered on the floor of his office room, had taken care to hide quite a small archive, undoubtedly documents of value, below one of its walls. From the way in which the place of deposit was contrived and marked, it appears highly probable that the house was abandoned in some emergency. All the deeds, etc., found here still retain their original wooden covers and string fastenings in perfect condition. Among the dozens of intact clay seals which attest these documents, impressions from Græco-Roman intaglios prevail. Their appearance, side by side with Chinese seals, seems to symbolize as it were the part played by Scythia extra Imaon in the early cultural interchange between the classical West and the Far East.

Near several of the ruins the ancient orchards, fenced gardens, canals, etc., could be traced with great clearness, showing how little the economic conditions differed from those of the present oases. On the other hand, surveys effected in the desert beyond, showing the course and extent of the river from which this ancient colony drew its irrigation, strikingly illustrated the great physical change which has taken place here since the settlement was abandoned. An instance of the clearness which prevails for certain periods in the desert atmosphere, so much abused for its dust haze, may find mention. For several days at the close of October the main Kunlun range, some 140 miles away to the south, could be made out so distinctly that it became possible to connect our position at the old site by triangulation with peaks previously fixed above Surghak by Surveyor Rai Ram Singh. On leaving Khotan I had deputed the latter for independent survey work along the foot of the great range. In spite of trying conditions of ground and climate, he attained the main object by extending the net of the Indian trigonometrical system from the headwaters of the Keriya river right through to the mountains between Charchan and Charklik. The northern slopes of the range were also mapped by plane-table on the scale of 4 miles to 1 inch.

The march through the desert between the Niya river and Charchan enabled me, among other tasks, to solve an archæological problem of

wider bearing. Hsuan-tsang, the great Chinese pilgrim, when passing here about 645 A.D., found no inhabited place on the ten days' march, but saw, about midway, ruins of old settlements abandoned to the desert. His reference pointed clearly to the site near the Endere river where, in 1901, I had excavated the ruins of a sand-buried fort. Epigraphical finds had proved it to have been occupied about the beginning of the eighth century, and abandoned during the Tibetan invasion soon after. The question thus arose whether we had here a definite historical instance of an old site abandoned to the desert, having been reoccupied after the lapse of centuries. Discoveries made on my fresh visit have furnished conclusive evidence. The low dunes around the old fort had shifted since my previous visit, and had exposed not far off much eroded remains of ancient dwellings. A careful clearing of the consolidated refuse heaps which had saved them from complete decay, brought to light Kharoshthi records on wood which clearly belong to the close of the third century A.D. or thereabout. Subsequently I found rubbish deposits of the same period embedded under the clay rampart of the later fort. It is significant that the second half of the seventh century, which must have seen Hsuan-tsang's ruined site brought to life again, is just the period when the re-establishment of Chinese power in Eastern Turkestan secured for a time peace and prosperity.

The case of Charchan, through which my journey took me at the close of November, well illustrates the *péripéties* to which these isolated settlements along the southern edge of the Turkestan desert have been peculiarly liable at different periods. A Chinese Buddhist pilgrim found, in 519 A.D., the oasis occupied by only a hundred families. Hsuantsang, more than a century later, saw there the walls of an old town still standing, but there were no inhabitants. Yet when Chinese rule had been re-established soon after his passage, Charchan figures once more as a place of importance. Marco Polo's description of the "Province of Charchan," fully verified on other points, mentions numerous towns and villages. But cultivation had completely disappeared by the end of the eighteenth century, and probably long before it. Settled once more by the Chinese as a small penal station about seventy or eighty years ago, Charchan has now developed into an oasis of steadily increasing size. There is abundance of water to permit of further expansion. Outside the oasis, to the west and south-west, marks of former occupation could be traced over extensive areas of wind-eroded ground in the shape of potsherds and similar hard *débris* of small size.

On the journey from Charchan to Charklik I was able to trace remains of the Mohammedan period in the wilderness of sandy jungle along the Charchan river, and to examine closely the ruins of an earlier settlement abandoned about the twelfth century close to the recently revived small oasis of Vashshahri. Antiquarian evidence collected at Charklik, the

present headquarters of the Lob Nor district, clearly proves that we must look here for the ancient capital of the Lob Nor region, as Hsuan-tsang knew it under the name of *Lou-lan*. Also Marco Polo's "town of Lop" may safely be assumed to have stood there. At Charklik I was kept busy for three days organizing my long-planned expedition to the ancient site which Dr. Hedin had first discovered in 1900 on his journey through the desert north of Lob Nor. The intervening distance was more than 160 miles, but there was no place nearer whence to draw the requisite transport, supplies, and labour. Charklik itself, reclaimed from the desert only some seventy years ago, offers scarcely more than the resources of a fair-sized village, and as its cultivators naturally dreaded a winter campaign in the distant desert, it would have been impossible to secure what I needed but for the energetic assistance of the local Chinese magistrate. By December 6 I was able to start for Lob Nor with a large *posse* of labourers and a month's supplies for the whole camp. As my route passed by Miran, where, not far from a small area of cultivation, ruins of "an old town" were reported to exist, I made a short halt there for the sake of trial excavations. They were rewarded by interesting discoveries more readily than I had expected. From rubbish-filled rooms which I cleared within a ruined fort still rising in parts to imposing height, there emerged in rapid succession close on three hundred Tibetan records on wood and paper, besides a variety of curious household implements, articles of military equipment, etc. There can be little doubt that these refuse layers accumulated during the period of Tibetan occupation which followed the weakening of Chinese power in the eighth century A.D. Whether the remains of a Buddhist shrine and of several stupas in the vicinity of the fort belong to the same period, or, perhaps, are of earlier date, will be investigated when I return to the site for further excavations.

At Abdal, a small fishing hamlet, from where the move into the desert was to be made, we left the ponies and all baggage that could possibly be spared. The question of arrangements about "transport and supply" thence was rather an anxious one. I had been able to collect only twenty-one camels, and had to take with them, over 100 miles of absolute desert, the *impedimenta* of a party numbering over forty people, including supplies for a month, and water sufficient to last us all for a fortnight. Fortunately, severe cold had set in just in time for the latter to be taken in the form of ice. Otherwise the climatic conditions were sufficiently trying, with minimum temperatures falling to as low as 48° Fahr. of frost, and an icy wind blowing from the north-east for varying periods almost every day. The route followed on the seven days' march to the ancient site lay necessarily close to the one taken by Dr. Hedin on his memorable journey of 1900 in the reverse direction. But for the first part the physical aspects of the ground traversed showed a notable change. The great newly formed lagoons in which the

waters of the Tarim had then spread northward, have since almost completely dried up. The water of the rare pools left behind in the salt-encrusted depressions was so salt that, in spite of the great cold, it had not yet frozen.

In the desert beyond finds of worked flints and other implements of the Stone Age, together with fragments of very coarse pottery, occurred frequently over stretches of wind-eroded ground. These proofs of early human occupation cropped up along our track through the whole of the extensive area believed to form part of an ancient lake-bed. The first relics of historical times, in the shape of Chinese coins belonging to the early centuries of our era, were met with fully 10 miles south of the site. The remarkable accuracy with which the position of the latter proved to have been fixed in Dr. Hedin's map, enabled us to find the ruins exactly where we first looked for them, even though the ground traversed, with its maze of deep wind-cut trenches and intervening steep clay banks, was as deceptive to the eye as it was difficult for the camels.

Thus by the evening of December 17 I was able to pitch camp at the foot of the ruined stupa, which stands out in this weirdly desolate landscape as the landmark of the main group of ruins. A blizzard which we had encountered on the previous day proved a blessing in disguise; for the snow it brought, light as the fall was, enabled us to extend our stay at the site to the length needed for systematic excavations, even though the springs at the foot of the Kuruk-tagh, about two marches northwards, from which I had hoped to replenish our store of ice, failed us. Their water was too salt to be drunk even by the camels, and the ice they had just begun to form was unfit for human consumption.

The excavations carried on unremittingly for eleven days at the several groups of ruins have yielded plentiful results. It is true, wind-erosion had worked terrible havoc among the dwellings constructed of timber and plaster walls, exactly like those of the Niva site; but others had retained a sufficient cover of drift sand or consolidated refuse to afford protection to many interesting relics. In a large rubbish heap, fully 100 feet across, we struck a particularly rich mine. The finds of written records, on wood and paper, proved throughout remarkably numerous, considering the limited size of the settlements and the number of extant buildings. The majority of the records are Chinese, and still await examination by my *literatus*, but the number of Kharoshthi documents is also considerable. Their character and the observations made as to their places and conditions of discovery, clearly indicate that the same early Indian language as found in the records of the Niva site, was used locally also in the Lob Nor region for administrative purposes and private business. Considering the great distance which separates Lob Nor from Khotan, this uniform extension of an

Indian language to the extreme east of the Tarim basin has a special historical significance. No less striking is the agreement which the constructive features of houses and shrines, the architectural wood-carvings, objects of industrial art, etc., discovered here present with those of the Niya site. Even without the evidence of dated Chinese documents and of the numerous coin finds, it would suffice to prove that the Lob Nor ruins were abandoned about the same time, *i.e.* the close of the third century A.D.

Clear evidence has been obtained showing that the principal group of ruins represents the remains of a small fortified station garrisoned by Chinese troops. Its purpose was manifestly to control the route leading from Sha-chou, on the extreme west of Kansu, to the oases along, and to the north of, the Tarim. From a variety of indications, it may be concluded that the settlement around this station derived its importance far more from the traffic with China which passed through it than from the resources of local cultivation. This source of affluence may account for the relatively large number of Buddhist religious structures.

By December 29 the exploration of all remains traceable was completed. Sending the main camp with the archæological "proceeds" back to Abdal, I set out myself with a few men through the unexplored desert south-westwards. We reached the Tarim safely after a seven days' tramp, but, owing to the steadily increasing height of the ridges of drift sand we encountered, progress was far more difficult than on the journey from Lob Nor. In its physical aspects this part of the desert showed certain marked differences. The ground, where not covered by dunes, bore here, too, indications of having formed part of an ancient lake-bed. But the rows of dead trees so frequently met on the previous route, marking the banks of old lagoons or river courses, were soon left behind here. Relics of the Stone Age were met with at intervals.

After surveying some localities of archæological interest on the lower Tarim and Charchan rivers, I am now proceeding to resume my excavations at Miran. On their completion, I intend to set out on the month's journey to Sha-chou. Ancient remains are not likely to be met on this desert track until we reach the outposts of old Chinese occupation about Lake Kara Nor. Yet the knowledge that I shall be following the route of Hsuan-tsang and Marco Polo, and what was once a main line of communication between Cathay and the West, is bound to give interest to the journey.

Camp Jigdalik-oghil, January 15, 1907.

P.S.—I have been obliged to postpone the despatch of the men who are to take my mail along with the collections of antiques to Kashgar, and this enables me to add a brief note on my resumed excavations at Miran. Their results have far exceeded my hopes. A complete clearing

of the ruined fort brought the number of Tibetan records found in its rubbish heaps to a total of close on a thousand. There can be no doubt that the stronghold was intended to guard the direct route to Shachou, which also at the present day passes below the fort walls. But of far wider interest and importance are the art remains which emerged from the *débris* mounds of the Buddhist shrines previously mentioned. These must have been in ruins for four or five centuries before the Tibetan occupation. In one of them there came to light colossal stucco relievos showing the closest relation to Græco-Buddhist sculpture of the first centuries of our era. The influence of classical art is reflected with surprising directness in the fine frescoes which cover what remains of the walls of two circular temples enclosing stupas. The main paintings, which illustrate scenes of Buddhist legend or worship, are remarkable for clever adaptation of classical forms to Indian subjects and ideas. But even more curious are the figures represented in the elaborate fresco dados. They are so thoroughly Western in conception and treatment that one would expect them rather on the walls of some Roman villa than in Buddhist sanctuaries on the very confines of China. One cycle of youthful figures in a gracefully designed decorative setting represents the varied joys of life—a strange contrast to the desolation which now reigns in the desert around the ruins, and, in fact, through almost the whole of this region. Kharosthi inscriptions painted by the side of the frescoes, and pieces of silk bearing legends in the same script indicate the third century A.D. as the approximate period when these shrines were deserted. The excavations and other labours were made very trying by intense cold and the frequency of icy winds, which sweep with their full force this bare desert glacis of the mountains.

Camp Miran, February 6, 1907.

MAP OF THE ANGLO-GERMAN BOUNDARY FROM THE VICTORIA NYANZA TO KILIMANJARO.*

The map is a reduction from the topography, on the scale of 1 : 100,000, made by the English and German sections of the Anglo-German Boundary Commission during 1904 and 1905. The country which lies on the British side of the boundary was surveyed by the British, that on the German side by the German, section of the commission. The framework on which the topography is based consisted of a single series of well-conditioned triangles observed with 6-inch and 5-inch micrometer theodolites, with an average triangular error of ± 6 seconds. One end of this series includes the Cape observatory—Aden telegraphic

* Map, p. 116. To illustrate Major G. E. Smith's paper, *Geo. Jour.*, vol. 29, p. 249 (March, 1907).

longitude point on the British Consulate at Zanzibar, and the chain reaches as far as the topography does to the west.

The heights are all trigonometrical. Vertical angles were taken on each ray at all the main triangulation stations. The initial height was that of Chala hill, which had been fixed by the Anglo-German Boundary Commission of 1892 with reference to the mean sea-level of the Indian ocean at Vanga. The line of heights thus carried up to Victoria Nyanza differed some 8 feet only from that brought up by the Uganda railway levels from Mombasa.

At the scale on which this map is published, 1 : 500,000, the physical detail may be said to be correct, and will require no alteration even if a more accurate survey be made later on.

The country in the area surveyed differs in no way from the usual African upland bush, whose characteristics vary but little with the altitude from 1500 to 5000 feet above the sea. At altitudes greater than 6000 feet the vegetation assumes a more park-like character, such as one is accustomed to see at home. The density of the forest growth depends on the rainfall or condensation, which varies according to the aspect of the slopes. These conditions include all the varieties of country included in the survey. Looking at the map, we see that the country from Lake Jipé on the east rises gradually to the plains on the east and north of Kilimanjaro, culminating at a height of 19,318 feet in the highest point of the snow-covered crater edge of Kibo. From these plains the country rises gradually to Mount Erok, falling again through a very broken country full of countless successions of parallel (north and south) faults to the bottom of the great Rift-valley.

This is the lowest level reached by the survey, 2000 feet at Lake Natron. The western escarpment of the great Rift-valley rises from the shore of this lake to a height of over 7000 feet in a single and almost vertical steep to the summit of Mount Sambu. The boundary-line then rises to about 8300 feet over a series of rugged spurs and deeply cut densely wooded gorges. The park-like country at the summit gives way gradually, as the country falls, to the drier thorn-bush of the Mara river plains. Then from the top of the Isuria escarpment, which, unlike the western side of the Rift-valley, rises as an almost unbroken barrier along its whole length, we find the scattered clumps of bushes and long grass giving way with the drop in height, as the country falls to the shore of Victoria Nyanza, to the thorn bush and yellow burnt-up grass of the lower veld.

REVIEWS.

EUROPE.

Northern Sweden.

'Norrland.' Naturbeskrifning af A. O. Högbom. Almqvist & Wiksells Bogtryckeri: Uppsala and Stockholm. 1906. Pp. 412. *Maps and Illustrations.*

The northern districts of Sweden, known collectively by the name of Norrland, extend along the Gulf of Bothnia from the Dal river south of Gefle, northwards to the Finnish boundary at the Torne river, and inland to the mountain backbone of the peninsula on the Norwegian frontier. With an area of more than 100,000 square miles, they form nearly three-fifths of the Swedish territory, but at present they are sparsely populated, and are chiefly noted for their rich iron-mines in Norrbotten, at Gellivare, Kirunavara, and Luossavara. Information about the physical features, economic resources, etc., of Norrland is to be found only in scattered articles and publications not readily accessible to those who have most need of it, and therefore it was proposed some years ago by Dr. Franz Kempe that a series of handbooks should be compiled, and with his assistance and support this project is now being carried out under the supervision of Prof. Högbom. The present volume, the first of the series, contains a general survey of the geology, climate, fauna and flora of Norrland, drawn from works of the author himself and those of other specialists, lists of which are given at the end of each section. Norrland trends from south-west to north-east, and its geology and configuration correspond to this direction. Archæan rocks, chiefly granite and gneiss, with large areas of porphyry, porphyritic schists, clay slates, and mica-schists, stretch far inland from the Gulf of Bothnia. West of these is a small zone of Silurian rocks, while the mountain axis of the peninsula is composed of rocks partly pre-Cambian (Seve group) and partly of Silurian age (the Köli group), the latter, however, differing so much in appearance and character from the rocks of the Silurian zone already mentioned that they have been marked on the geological map by a special colour. When the country emerged from the sea at the end of the Silurian period, its surface in all probability sloped gradually towards the south-east in the direction of the existing river-valleys. The erosion of these valleys was probably commenced when the surface rose far above the tops of the present mountains. A striking proof of this is the occurrence of transverse valleys where the rivers have cut through rocks offering greater resistance to denudation. In some cases the breaches are incomplete, the stream having been unable to excavate its bed as rapidly as the ground behind it was lowered by denudation. The deposits of loose detritus date from the last stage of the Glacial period or later times, all earlier accumulations having been swept away by the ice-sheet. Glacial detritus is widely distributed, and moorland occupies about 30 per cent. of the total area, while marine deposits indicate a transgression of the sea up to 900 feet in some parts. Lakes are numerous, and occupy about 6 per cent. of the total area. Most of them, including Hornafvan, the largest and deepest of all (725 feet), have been formed by damming, though the deepest parts may in some cases lie in rock basins. A large reserve of motor force is stored up in falls, including the Krångede falls on the Indals river, with about 60,000 horse-power, and the Harspràng on the Luleå, with 46,000. Prof. Högbom also discusses the flora, in the distribution of which the most marked line is the upper limit of conifers running at heights of 1400 to 2600 feet above sea-level, above which the birch region extends to a vertical height of 165 to 650 feet; and he also points out several anomalies of distribution which are still not thoroughly explained. Similar difficulties also occur with regard to the fauna. The peculiarities of the

water-fauna are common to the Baltic basin, the relict fauna of which has been often discussed. It is interesting to learn that a skeleton of a Greenland seal has lately been found near Sundsvall under circumstances which prove this animal to have existed in the Gulf of Bothnia during the Littorina period.

The foregoing brief notes will serve to show how wide a range of subjects is dealt with in Prof. Högbom's work, which is accompanied by geological, hypsometrical, and other maps, and numerous illustrations. For those who wish to study any particular subjects in greater detail the bibliographical lists will be a valuable guide.

AFRICA.

Abyssinian History.

'Rerum Æthiopicarum Scriptores occidentales inediti a sæculo xvi. ad xix. curante C. Beccari S.I.' Vols. 2 and 3, "P. Petri Paez S.I. Historia Æthiopiæ," Liber i. et ii., and iii. et iv. *Plates*. Vol. 4, "P. Emmanuelis Barradas S.I. Tractatus Tres historico-geographici." Romae: C. de Luigi. 1905–1906. *Price* 20*s*. 8*d*. *each vol*.

There is a notice of Father Beccari's introductory volume in this *Journal* for August, 1904. Volumes 2, 3, and 4, which have appeared since, contain the works of Peter Paez and of Barradas; they amply fulfil the hope of important additions to historical geography. Paez's manuscripts have been utilized by later writers, who have extracted his valuable remarks on the expedition of Christovão da Gama, but the modest words in which he records his culminating feat, the discovery of the sources of the Blue Nile, must always retain their interest. With his words and Bruce's before us, we can see the character of the latter's attack. There is no space to expose the whole of Bruce's misstatements. Suffice it to say that Paez makes no mention of a mountain full of water, out of which Bruce makes such dreary fun; that he does not mention a place called Sabala, as Bruce says, but one called Çahalâ, which word differs little from Bruce's Sacala; and that where Paez estimates a certain object as an "espingarda" shot distance, Bruce has no authority for translating it a "cannon shot," or for referring to it later as "a league," or "the largest range of a shell shot from a mortar," because "espingarda" is a matchlock—the weapon of an infantry man. No excuse can avail Bruce, for he says he had consulted two manuscripts, and that he had with him on the spot a copy from one of Paez's accounts. Paez was born in 1564, and was in India in 1588 when first detailed to accompany Antonio Monserrate to Abyssinia. Their attempt to reach that country failed, and they had to spend long years of captivity in Arabia, chiefly in Sana and Mocha, before they again saw Goa in 1596. Their mention of the coffee they drank in Arabia is the earliest notice of it by a European traveller in that country. It was not till 1603, and then alone, that Paez succeeded in reaching Abyssinia; he spent the rest of his life, till his death in 1622, in travelling from one end of it to the other. Omitting his refutation of the errors of Urreta, a writer on Abyssinia long since forgotten, and his dissertations on dogmatic theology, there is a residue of very great value. He was a man of considerable ability, who utilized his Arabian captivity to learn Arabic and Hebrew, and who, judging from his translations of chronicles, acquired Amharic or Geez in Abyssinia. Where his religious training does not interfere, he is a cool and sagacious observer. He is told in Arabia that the Arabs had seen his companion Monserrate floating in the air on the level with the treetops while he prayed. This is retailed; but when he is told in Abyssinia that vultures throw stones at their pursuers, he watches the birds as they are driven out of the royal camp by the pages, and reaches the rational explanation that the birds do not throw stones, but that if they step on a loose one they may kick it back as they run. His account of the unsuccessful attempt of

Antonio Fernandez to penetrate to the African coast at Melinde is interesting. On page 271 of vol. 2, the word *Xangada* has puzzled the editor; this form exactly reproduces the sound of the Southern India word *Shangadam*, "a raft." Barradas carries much less weighty metal than Paez. He was born in 1572, and though commencing with the Jesuits in 1587, he was not fully admitted until 1612, and then in India. In the contemporary confidential note of his corps he is described as "judicium mediocre" and "constitutio cholericus, adustus." He reached Abyssinia in 1624, just after Paez's death, and left with the other Jesuits on their expulsion in 1634. His knowledge of the country is confined to Tigré, but that he knew well, and his description of it and of the manners and customs of its people is very interesting and minute, and shows considerable power of observation. Three treatises of his are published here: the first is of no value—theological—the second is his account of Tigré, and the third a very detailed description of Aden. He apparently had never seen the printed accounts of Da Gama's expedition, but his report of the oral traditional account of the events occurring in Tigré is exceedingly valuable, and shows that recent research is justified in the conclusions drawn as to the line of Da Gama's advance. Barradas died in India in 1646.

R. S. W.

German Nyasa and Rovuma Lands.

Dr. F. Fülleborn, 'Das Deutsche Njassa- und Ruwuma-Gebiet, Land und Leute, nebst Bemerkungen über die Schire-Lander. Mit Benutzung von Ergebnissen der Njassa- und Kingagebirgs-Expedition der Hermann und Elise geb. Heckmann Wentzel-Stiftung verfasst.' Deutsch-Ost-Afrika, vol. ix. Berlin, 1906. Pp. 636, figs. 210. *With Atlas*, 119 *Plates, and* 2 *Maps*.

The series of monographs entitled 'Deutsch-Ost-Afrika' is well known as including some of the most important contributions to the scientific geography of tropical Africa. The ninth volume, by Dr. Friedrich Fülleborn, maintains the high standard of this work. It describes the southern part of German East Africa, including the districts between the coast and the northern part of Lake Nyasa. Most of the area is in the basin of the Rovuma river, which divides the German territory from Mozambique.

The author had excellent opportunities for quiet research. He lived in the country from 1897 to 1900 as doctor in the military service. He accompanied the Wentzel Zoological Expedition to Nyasa and the Kinga mountains, and he was engaged in some military excursions against insurgent natives, and they give unusual opportunities for making extensive ethnographic collections. As a medical man the author has naturally turned his attention mainly to anthropology. He devotes two short chapters to a concise narrative of his journeys, and he briefly describes the chief feature in the geography, geology, and biology of the region.

The chief feature of this book is its monographic account of the natives. The information given is detailed; and it is arranged with such excellent method, and provided with so good an index, that the material is all easily available for reference. The index consists of 64 pages, with three columns on a page, and with eight extra pages for index to authorities.

The natives are, of course, all Bantu, and the author divides them into eight tribes, of which the Wamuera, Wakonde (and their branch the Wamatambwe), and the Mawia are the aborigines; the rest—the Wayao (Livingstone's Ajawa), the Wamakua, Wangindo, the Wamanganja and their allies, and the Wandonde—have immigrated into the country in recent times. Seventy or eighty years ago the Wamuera were a much greater people than they are to-day. The Wamatambwe were a very numerous race in the days of Livingstone, but they have been driven by invasions of the Wayao and Makua from their old home in the lowlands beside

the Rovuma, and forced to migrate further up the valley, where the remnants of the tribe are scattered among other people. The Wayao are the most important of the recent invaders; their chief area is now in Portuguese territory south of the Rovuma, but the author thinks they originally came from the country behind Kilwa, and their present tendency is to return northward. One chapter is devoted to sport and fishing; but it describes native methods and not the author's experiences. There are many interesting additions to knowledge of the initiation ceremonies, by which boys and girls are admitted to the ranks of the adults.

There is much in the country that reminds the reader of the corresponding highlands to the south of the Zambezi in Mashonaland. The physical conditions of the two countries are in many respects similar: the people are allied in race; they live in huts of the same design, and often protected between granite tors as in the kopjes of Rhodesia; the natives use similar weapons, and show the same skill in smelting iron—of which industry the author gives an excellent account (pp. 166–174). The people in both districts are fond of depicting animals; they make wall-paintings of giraffes, zebras, and antelopes, which are cruder, but of the same character as the Bushmen paintings of Cape Colony; and the members of some tribes, such as the Wadonde and Wamuera, tattoo figures of antelopes, trees, and birds upon their bodies. The author gives detailed and most interesting accounts of native architecture; but we look in vain for any traces of stone buildings of the Zimbabwe type. The explanation of their absence may be the lack of important mineral wealth in the Rovuma basin; it yields garnets (to the value of 63,000 marks in the year 1901–1902), as well as beryls and other stones; it has some ores of copper and widely distributed iron; and in the schists of the Livingstone mountains there are some quartz veins containing a little gold, but the gold ores are too poor to work. Hence there is no trace of former extensive mining operations, and there appear to be no stone buildings such as those on the goldfields of Rhodesia.

The country in the main consists of a plateau of gneiss disrupted by the earth-movements to which East Africa owes some of its most striking geographical features. The author gives a sketch-map of the rift-valley system at the northern end of Lake Nyasa, which he has drawn up in consultation with Dr. Kohlschutter, incorporating in it the latest information available. The Nyasa rift-valley breaks up at its northern end into two parts, surrounding the Unyika Horst, which is cut off from the Nyasa-Tanganyika plateau by the Inyamanga rift-valley; the two branches reunite to form the Rukwa rift-valley, which joins that of Tanganyika at Karema, the Mkamba river flowing through the north-western part of it. The Ruaha rift-valley branches to the north-east from the main line, and separates the Ukimba plateau from the Elton plateau, which is the northern end of the Livingstone mountains. The southern end of these mountains is marked by a tectonic fracture, which the author calls the "Ruhuhu-Bruch."

The frontispiece is a fine view of a typical crater lake, that of the extinct volcano Ngozi; but volcanic activity in this district is dead. In the Songwe valley there is a group of hot springs, which have deposited an extensive mass of sinter. These "Grafin-Bose" hot springs stand, however, on a great fault, and therefore appear to be due to tectonic and not volcanic causes.

The volume is accompanied by an atlas of unusual value. It includes two maps: one a copy of part of the official map of the state on the scale of 1 : 1,000,000, on which is marked the author's routes. A second map on the scale of 1 : 510,000 illustrates the topography of Konde Land. The maps show by coloured numbers the sites and direction of the photographs in the atlas, which consists of 119 plates (12″ × 17″) containing 845 figures. They give a pictorial account of the country,

and a most graphic representation of the life of the people. They show the banana-leaf bivouacs, the bamboo bridges, the fortified villages, the gigantic fish-traps, and the methods of iron smelting. They illustrate some of the diseases and the tribal marks, including scar-tattooing and the manipulation of the hair and teeth among representative tribes. One set of ten photographs shows a man making the manual signs for the numerals 1 to 10. Another illustrates a method of inducing a cow to yield milk, which is well known from its use among the Masai, but is probably not adopted in British dairy farms. J. W. G.

GENERAL.

The First Circumnavigation of the Globe.

'Magellan's Voyage around the World.' By Antonio Pigafetta. The original text of the Ambrosian MS., with English translation, notes, bibliography, and index. By James Alexander Robertson. 3 vols., large 8vo. *With Portrait, and numerous facsimiles of the original Maps and Plates.* Pp. 273, 313, and (index) 88. Cleveland, Ohio: The Arthur H. Clark Co. 1906.

Our knowledge of the circumstances of the first circumnavigation of the globe is of singularly unequal character. In some respects it is astonishingly full. We have, for example, the roll of each ship's company—the names of the men, the towns or countries whence they came, and the rank or office that each held. The documents in the Seville archives give a complete list of every article carried in the fleet, even to the number of bells and coloured handkerchiefs intended for barter. But no regular ship's log exists to tell us of the events of the voyage, and the nearest approach to it that we get is the scanty derrotero of Francisco Albo. The narrative of the Italian, Antonio Pigafetta, remains as yet—and is likely to remain—our chief source of information concerning Magellan's wonderful voyage, and it is rather curious that until now we have been without any adequate and trustworthy English version of it. Lord Stanley's translation, published for the Hakluyt Society in 1874, was unfortunate in being a synthesis, partly founded on one of the French MSS. in the Bibliothèque Nationale, and partly on Amoretti's version, which was itself an inaccurate reproduction of the Italian (and oldest) text existing in the Biblioteca Ambrosiana in Milan. This has been the sole available source to the English reader, and accordingly the volumes which Mr. J. A. Robertson here gives us are particularly welcome. They are three in number. Vols. 1 and 2 contain the Italian text and its translation on opposite pages, very full notes (relegated to the end of each volume), and a lengthy bibliography, while vol. 3 is entirely devoted to the index.

Mr. Robertson, though making free use, with all due acknowledgment, of Andrea da Mosto's excellent edition, has himself made the transcript of the Italian from the original, and has collated the text with the French MSS. in the Bibliothèque Nationale in Paris, incorporating all the variants in the notes. These are further enlarged by the readings and comments of previous writers upon Magellan and his expedition, and by Mr. Robertson's own criticisms. The volumes were originally intended only to be issued as a portion of the colossal series on the Philippines now appearing under the editorship of Mr. Robertson and Miss Blair, but it has been wisely decided to publish the work as a small separate edition in order to render it more accessible to the ordinary reader.

In printing the Italian text, the author tells us, "great care has been taken to represent correctly the many peculiar characters and abbreviations occurring in the old Italian, and for this purpose many special characters have been designed and type specially cast." We are not sure that the step was altogether an advisable one. The conjunction of modern roman with these characters, and more especially with

a series of italic letter *s* which stands for the long s in the manuscript, gives a mixed effect which is far from pleasing. Nor, though one may have every respect for a desire for accuracy which has led the author to claim that "the peculiarities of the manuscript have been carefully preserved, even to the spacing," do we think it necessary that this should be carried to the length of dividing words, so that "bombarde" becomes "bom barde," "terribili" "teri bili," "beverono" "beue rono," and so forth. Passing to the translation, we find a certain inequality in the standard adopted. While modern English is used, and considerable effort is apparently made to give as close a rendering of the text as possible, so that we even have "Spagnia" and "Portagalo" where Spain and Portugal might well have served, there are frequent occasions when the English is either too slavish or too free. Thus "the Ocean Sea" and "the holy bodies" can hardly be considered satisfactory equivalents of "Mare Occeano" and "Corpisanti;" and, on the other hand—to pass over various instances of colloquial English—it is a little startling to be confronted with some full-blown Americanisms. In the description of the flying-fish pursued by the albacores, the latter are stated to "run along back of them under the water," and a little further a town is spoken of as "located" at the end of Java Major. Many things, indeed, are "located." But perhaps the most salient instance is the translation of "et non se afaticarebeno se non dui in comandare ali marangoni como douescero fare," as "they would not suffer any fatigues beyond two of them to boss the carpenters in their work." It would be invidious, however, to dwell on these minor drawbacks, in presence of the fact that Mr. Robertson's book gives the reader for the first time the true text of Pigafetta, with a sufficiently good working translation, edited and annotated in the fullest manner, and with the Italian text throughout collated with that of the earlier of the two French manuscripts in the Bibliothèque Nationale and the Eden version as published by Arber. Not least in value, too, is the excellent critical bibliography of Pigafetta MSS. and the printed books relating to the voyage. With regard to the much-debated question as to the language in which Pigafetta gave his story to the world, Mr. Robertson holds that the evidence conclusively proves that he wrote or dictated his relation in Italian; that the Ambrosian MS. is a contemporaneous copy of the one presented to the Grand Master of Rhodes; and that the two Paris MSS., and in all probability the Nancy MS., are translations (the first two very imperfect) of the Italian by a Frenchman only indifferently acquainted with the language.

Pigafetta's original charts, which are numerous, are carefully reproduced, and add to the interest of the work. They should afford material aid in the identification of the places mentioned by him in his narrative, with regard to which much still remains to be done.

F. H. H. G.

SHORT NOTICES.

Europe.—'Through Portugal.' By Martin Hume. (London: Grant Richards. 1907. Pp. xiv. and 317. *Illustrations.*) Graphic impressions of Oporto, Bussaco, Cintra, Lisbon, and other places of interest in Portugal make this an attractive volume, the value of which, to travellers, is enhanced by a chapter dealing with ways and means of journeying. Whether describing scenery or architecture the writer is equally clear, and the monotone illustrations are excellent; those in colour are much less successful.

'A Book of the Pyrenees,' by S. Baring-Gould (London: Methuen. 1907. Pp. 309. *Map and Illustrations*), a work as eminently readable as might be expected from its author, deals mainly with the history of the region of the Pyrenees, each chapter treating of some important centre or some well-defined district. A descriptive character, however, runs through the book, and word-

pictures here and there, with a few good photographs, do justice to the natural beauties of the region.

Asia.—'Life and Labour of the People of India.' By Abdullah Yusuf-Ali. (London: Murray. 1907. Pp. xii. and 360. *Illustrations.*) The title of this work precisely indicates its scope; those of the two first chapters, "Town Life" and "Village Life," show that it contains matter of a certain geographical significance. Though a subject so widely ramifying must needs be treated, in these limits, either generally or by means of isolated examples, the result is thoroughly instructive, especially as coming from a writer who is of the people.

'Indian Pictures and Problems.' By Ian Malcolm. (London: Grant Richards. 1907. Pp. xiv. and 294. *Illustrations.*) This book is divided into two parts, entitled respectively "India" and "Burma," and its chapters cover a wide range of subjects—from notes on public school life to a description of the Kolar goldfields, from native religion in Burma to frontier politics and administration. The result to be gained by the reader is therefore rather a series of detached impressions than a connected picture, and the book becomes rather of momentary interest than of permanent value for reference.

'The Seven Cities of Delhi,' by G. R. Hearn (London: Thacker. 1906. Pp. xiv. and 319. *Plans and Illustrations*), is a careful study in the nature of an elaborated guide-book; that is to say, one section is worked out in the form of an itinerary, and the topography and history are framed so as to be of use to visitors to one of the most interesting cities in the world. The arrangement is thoroughly systematic; there is a bibliography, and the author's plans and photographs are excellent.

Africa.—'The Sudan.' By H. Karl W. Kumm (London: Marshall. 1907. Pp. xiv. and 224. *Maps and Illustrations.*) This book deals with the Sudan mainly from the point of view of missionary work, whether treating the country descriptively or historically. One chapter, however, classifies and tabulates vegetable products; another does the same for meteorological observations; while a third deals briefly with waterways, and includes a synopsis of the conditions of the Benue month by month.

'A Picnic Party in Wildest Africa,' by C. W. L. Bulpett (London: Arnold. 1907. Pp. xiv. and 246. *Maps and Illustrations*), deals with a trip in the district of the head-streams of the Sobat. Mingled with the narrative of travel and sport, it contains much miscellaneous description of things seen; the notices of intercourse with the natives, and the topographical details, especially, are of no little interest, and the whole work, while without scientific pretensions, is thoroughly readable.

'Sketches in Mafeking and East Africa.' By Major-General R. S. S. Baden-Powell. (London: Smith, Elder. 1907. Pp. 183. *Maps.*) The text of this book is brief and fragmentary, but not altogether uninstructive; the sketches are the principal feature, and, whether humorous or otherwise, are generally entertaining. Some of the colour reproductions (*e.g.* that of Victoria falls) are beautiful; others are not.

'Uganda by Pen and Camera,' by C. W. Hattersley (London: Religious Tract Society. 1906. Pp. xviii. and 138. *Illustrations*), gives short directions for the journey to and travelling in Uganda, and a narrative of missionary work and its results there.

'Le Periple d'Afrique. Du Cap au Zambèse et à l'Océan Indien.' By Henri Cordier. (Paris: Librairie Orientale et Américaine, [*n.d.*]. *Illustrations.*) Prof. Cordier represented the Société de Géographie on the occasion of the British Association's visit to South Africa in 1905, and this is his narrative. As a French view of the proceedings, and of the country and towns visited, it is of much interest; it is full of excellent, though brief, geographical, ethnographical, and economic

notes; and the journey and arrangements are described from day to day appreciatively, and not without humour.

America.—'Camp-fires in the Canadian Rockies,' by W. T. Hornaday (London: T. Werner Laurie. 1906. Pp. xvii. and 353. *Maps and Illustrations*), is an entertaining narrative of sport, and both the text and the photographers assist to give the reader a mental picture of the country. There are some few scientific notes, and the map of the distribution of the white mountain goat is original.

'The Ohio River.' By A. B. Hulbert. (New York and London: Putnam's Sons. 1906. Pp. xiv. and 378. *Maps and Illustrations.*) This is mainly a history of events connected with the Ohio and the places on its banks, conceived in a somewhat florid style, but thoroughly interesting. The river, a natural highway, lends itself to such treatment as no other physical feature can, and, in issuing this volume and others similar, the publishers help to show how one department of geography can be made an attractive study.

'Paraguay, das Land der Guaranís,' by Wilhelm Valentin (Berlin: Hermann Paetel. 1907. Pp. viii. and 323. *Illustrations*), is, within its limits, a comprehensive study, of a type more frequently produced in Germany than in England. It deals with the geographical and economical and, briefly, with the historical aspects of Paraguay, and should form a useful work of reference on that country.

Pacific.—'From Fiji to the Cannibal Islands.' By Beatrice Grimshaw. (London: Nash. 1907. Pp. xii. and 356. *Illustrations.*) The Cannibal islands is hardly an illuminating term, and perhaps, for the sake of the interest of the moment, it is a pity that the title of this book does not specify the New Hebrides. Out of a mass of what can only be described as the usual sort of personal narrative, it is possible to pick plenty of interesting descriptive information about these and other islands much less familiar than Fiji. The illustrations, as a whole, cannot be commended.

General.—'Lectures on British Colonization and Empire.' First Series. By F. A. Kirkpatrick. (London: John Murray. Published under the auspices of the League of the Empire. 1906.) This work is the first outcome of a scheme of the League to provide lecturers with a series of addresses on the British Empire. A list of lantern-slides (maps and pictures) is provided to accompany each lecture; these can be obtained from the League. The lectures are excellently framed; of the maps, the book, of course, gives no means of judging, but the subjects are well chosen. The selection of pictures (among which portraiture, episode, and scenery all have place) must have been so difficult as to disarm criticism; and the whole compels praise.

'The Rare Adventures and Painefull Peregrinations' of William Lithgow. (Glasgow: Maclehose. 1906. Pp. xiii. and 449. *Original Illustrations.*) This is a reprint, with very slight alterations (correction of printers' errors, etc.), of Lithgow's 'Editio princeps' of 1632. It has a biographical note and a new index, but is otherwise without annotation. It is excellently produced.

THE MONTHLY RECORD.

THE SOCIETY.

Honours to Members of the Council.—At a special congregation held at Cambridge on June 12, and presided over by the Duke of Devonshire, Chancellor of the University, honorary degrees were conferred, among

others, on three of the present members of the Society's Council, two of them being Vice-Presidents. That of LL.D. was given to Lord Curzon, and that of D.Sc. to Sir Clements Markham and Sir Thomas Holdich. The following is the text of the speeches made by the Public Orator in introducing the recipients:—

Assurgit proximus Uniuersitatis Oxoniensis, sororis nostræ uenerabilis, Cancellarius, qui primum inter Etonenses educatus, deinde præmiis in historia Academicis ornatus, postea non modo Indiæ sed etiam rerum exterarum in prouincia administranda domi spectatus, Asiæ trans partem magnam ab imperio Persico usque ad imperii Sinensis fines ultimos itinera magna confecit, confecta litterarum monumentis stilo lucido conditis commendauit. Per annos duodecim inter Britanniæ senatores electus, deinceps per septennium præclarum Regis nostri uicarius illustris Indiæ toti gubernandæ cum laude plurima præfuit. Qui Indiæ administrationem suam orationibus plurimis et feliciter illustrauit et fortiter uindicauit, nullo alio quam oratoris maximi Romani præconio dignus est. "Quid autem" (ut oratoris illius uerbis utar) "reperiri tam eximium aut tam expetendum potest, quam istam uirtutem, moderationem animi, temperantiam non latere in tenebris neque esse abditam, sed in luce Asiæ, in oculis clarissimæ prouinciæ atque in auribus omnium gentium ac nationum esse positam?" "Simul etiam illud" India "cogitet, nullam ab se neque belli externi neque domesticarum discordiarum calamitatem afuturam fuisse, si hoc imperio non teneretur."

Duco ad uos uirum admodum honorabilem, BARONEM CURZON.

Sequitur deinceps Regiæ Societatis Geographicæ per annos quinquaginta quidem minister indefessus, per duodecim præses præclarus, cuius sub ductu Societas illa diu floruit, et non modo Britannorum in doctrinæ sedibus honoris locum est adeptus, sed etiam terras remotissimas, et præsertim regionem polo Australi propinquam, explorauit. Idem quot iuuenes rei naualis peritos trans maria longinqua scientiarum finibus proferendis excitauit! Quam feliciter ipse ex intimis Peruuiæ penetralibus arborem contra febrium impetus ui salutari præditam, etiam in Indiam, populi totius cum magno commodo, transtulit! Quot regiones peragrauit, peragratas litterarum lumine illustrauit! Ergo, et sibi ipsi, et collegis suis orbem terrarum totum explorantibus, nemo melius poëtarum Latinorum uerba illa potest arrogare:—

"Quæ regio in terris nostri non plena laboris!"
"Viximus insignes inter utrumque"—polum.

Duco ad uos Regiæ Societatis Scientiarum socium, Regiæ Societatis Geographicæ diu decus et præsidium, equitem præclarum, CLEMENTS ROBERTUM MARKHAM.

Societatis Geographicæ præsidi emerito nemo potest opportunius succedere quam præsidis ipsius uicarius, miles fortissimus, Indiæ totius explorator audax, qui præsertim in tellure Russorum imperio contermina, montium arduorum inter ambages, gentium barbararum inter arma, animo intrepido regionis difficillimæ, regionis prope inextricabilis, fines designauit. Idem in America Australi inter respublicas duas confines controuersiam magnam de limite communi exortam, populi utriusque non sine magno commodo, terminauit. Is autem qui scientiarum doctor hodie nominabitur, itinerum suorum libris stilo facili et facundo conscriptis, non immerito etiam laudem litterarum est adeptus.

Duco ad uos equitem fortissimum, THOMAM HUNGERFORD HOLDICH.

The International Council for the Investigation of the Sea.—This Council met in London for the first time by invitation of the British Government during the week beginning June 10. On the evening of

that date they were entertained to dinner by the Royal Geographical Society and the Geographical Club, when about thirty members of the Council were present. After dinner a meeting of the Society was held, when Dr Otto Pettersson, Acting President of the Council, gave a lecture on Oceanic Circulation; after that several representative members of the Council gave some account of the varied work which it has been carrying on during the past five years. During the rest of the week the Council held its official meetings, and were entertained by the Minister of Agriculture, the Secretary for Scotland, the Lord Mayor, and the Fishmongers' Company; they were also received at Buckingham Palace by the King, and many of them were present at the Annual Conversazione of the Society at the Natural History Museum, at South Kensington. On the Saturday, Dr. H. R. Mill, who is himself a member of the Council, entertained them at a garden party at his house at Mill Hill.

EUROPE.

The Scottish Peat Mosses.—Since publishing the results of his examination, in 1904, of the peat mosses of the southern Scottish uplands (*Journal*, vol. 27, p. 84), Mr. F. J. Lewis has extended his valuable researches to more northern portions of the same country. As in the former case, he has recorded the data collected, and the conclusions to be drawn from them respecting the climatic changes to which Scotland and neighbouring regions have been subject since the close of the glacial epoch in the *Transactions of the Royal Society of Edinburgh* (vol. 45, part ii., No. 13, 1906). The mosses examined in 1905 fall into two different groups: that of the western districts, represented by Skye and the outer Hebrides (north Uist); and the north and north-east Highlands, in Caithness, Easter Ross, and Inverness. As in 1904, a large number of sections, sometimes extending to a depth of 12 feet and upwards, were taken by the writer, and where these were impossible, borings were substituted. In the western districts the sequence of plant remains was shorter than elsewhere, none typical of arctic or sub-arctic conditions being met with at the base, where *Betula alba* and *Corylus avellana* were abundant immediately above the glacial deposits, showing that the peat began to form under temperate conditions, at least in the spots examined. This basal forest-bed, which is overlain by a large thickness of marsh and bog peat, is perhaps to be correlated with the lower buried forest previously described from the southern uplands, a great similarity being observable between the deposits in these and in the Hebrides. In this case the absence of intercalated arctic plants is possibly to be attributed to the low level at which the beds occur. The upper forest bed of the south will thus be missing entirely in the Hebrides, which might be expected to form a refuge for moisture-loving plants when dry conditions prevailed in the south and east of Britain. The deposits examined in the north and north-east show a much longer succession of beds, which display a marked correspondence throughout the areas examined. The lowest point everywhere to the prevalence of arctic conditions (marked by the presence of arctic willows and associated forms), which gave place gradually to a less rigorous climate, in which an alternation of humid with drier conditions may be traced. At one level a shrubby growth of birch is seen to have found a footing, but it is hardly to be correlated with the lower forest zone of the southern uplands. Its occurrence, over large areas, so soon after the cessation of arctic conditions, may be due to the fact that these had

lagged behind in the wet peat-covered areas longer than in drier neighbouring districts. Higher up, two separate zones of *Pinus Sylvestris* regularly appear, as against one only in the south of Scotland. Mr. Lewis inclines to the opinion that we have here an indication of climatic change, rather than of the action of local conditions, such as have been called into play by Dr. Gunnar Andersson to account for an alternation of forest formations and sphagnum beds in some of the Swedish mosses. The absence of the second zone of *Pinus* in the south may imply that the tree had already died out here, for it is well known that no natural pine forests occur in southern Britain at the present day. In the concluding part of the paper an attempt is made to correlate the various beds with the later glacial and inter-glacial periods. Mr. Lewis's researches, which it is to be hoped he will continue to prosecute in the future, are calculated to throw much light on the distribution of the British flora, which, as he points out, may owe more to the historical than the ecological factor. They may also help to explain the origin of the Greenland flora, with which some of the earlier remains in Scotland show distinct resemblances.

Tree-lines in the Eastern Alps.—Prof. Newole, of Vienna, has instituted investigations into the altitudinal limits of the various species of trees, and has reached the following main conclusions respecting their dependency on character of the soil, configuration of the land, and exposure, in the north-eastern part of the Eastern Alps. He gave special attention to the beech and pine, and the contrast exhibited between them. The pine mounts higher than the beech, the former rising to the average height of 5910 feet, the latter only to 4630 feet. Within its lower altitudinal region, however, the beech attains to higher situations in the Calcareous Alps than in the zone of primitive rocks. The pine, on the contrary, rises higher on the primitive rocks than in the Calcareous Alps. In the latter, the beech on southern exposures attains the average altitude of 4630 feet, but on northern and western exposures its altitudinal limit falls 300 feet lower. On the primitive rock of the Lower Tauern the beech sinks 230 feet lower still, climbing here to a height of only 4100 feet. The beech loves drought; it prefers sunny slopes, avoiding moist and shady ravines. In valleys in primitive rock it occurs only in lower sunny situations, and is sometimes altogether wanting even here, as also in valleys north of Judenburg, in Upper Styria. On limestone mountains, on the other hand, it mounts high, particularly on southern exposures, whereas here again it is vain to search for it in lower situations. Pine and fir there predominate. In the Calcareous Alps east of the Enns, the upper limit of the pine as a tall-stemmed tree lies at an average height of 4990 feet, as a dwarf at 5610 feet. On the primitive rock from the Wechsel to the lower Tauern, the pine as a tall-stemmed tree rises to the average height of 5630 feet; in the form of dwarf and scrub to 5940 feet. On gneiss the tall-stemmed pine rises, therefore, 650 feet higher than in the Calcareous Alps. The pine is indeed the dominant tree of the Alps. This, however, comes most strikingly to view on the relatively moister soil of the primitive rock. Yet it too affects the sunny slopes, even on limestone mountains. On such slopes it ascends the "Wiener Schneeberg" 590 feet higher than in the valleys and glens. The snow masses falling plentifully in the mountains, especially in spring, take a long time to melt in these shady ravines, and, besides the burden they impose, bring with them an overcharge of moisture, both circumstances injuriously affecting the after-growth. The influence of mountain shade is thus constantly in evidence. Regions of particularly great elevation are the domain of the birch and the Cembra pine. Newole found the birch on the Hochgolling (in the lower Tauern, south of the Dachstein, 9390 feet high) between 5970 and 6350 feet. Kerner von Marilaun, on the other hand, found the Cembra pine in the Tyrolese gneiss Alps in a zone between 5170 and over 6500 feet.

ASIA.

Dr. Tafel's Expedition to Tibet.—In spite of repeated ill luck, this traveller continues to show the most praiseworthy determination in his endeavours to explore some of the least-known parts of North-Eastern Tibet. It will be remembered that soon after his first entry into the Kuku-nor region (*Journal*, vol. 28, p. 398), his caravan was attacked by robbers, losing the greater part of its equipment, so that it became necessary to beat a retreat for the purpose of renewing the supplies. After reorganizing his party, the traveller once more set out, and all appeared to be going well, the caravan having advanced as far as one of the headwaters of the Yang-tse (the Machu of Wellby), when it was once more attacked by robbers and almost all the transport animals—so indispensable for travel across the inhospitable regions of Northern Tibet—were carried off. Letters printed in the fifth number of *Petermanns Mitteilungen* for the present year, the first written soon after this disastrous occurrence took place, picture the parlous plight of the party, whose only hope was to make its way back to Tsaidam with sadly reduced supplies (the greater part having been of necessity destroyed or abandoned) across a practically unknown region, the existing maps of which proved untrustworthy guides. The caravan was on the south side of the Marco Polo range, which had to be crossed in order to reach an inhabited region, but which long presented an impenetrable barrier, with its glaciers and deep snow. The party were in sore straits when they at last reached an encampment of Mongols. Dr. Tafel returned to Sining-fu, whence he wrote on January 15, 1907, announcing the completion of his preparations for a renewed attempt. Before the disaster he had travelled for five months across the north-eastern part of Tibet, subject, in some degree, to the Kuku-nor authorities. From Tsaidam he had crossed the Burhan Buda range and made his way to the ultimate head-streams of the Hwang-ho, which he explored thoroughly. Thence he proceeded to the upper Yangtse, where Tibetans were encountered, who showed themselves distrustful. The river seems to have been crossed, though no details are given of the further route. The country was exceedingly monotonous, and the geology (Dr. Tafel's special subject) uninteresting, the whole consisting of strongly tilted sandstones with a regular strike in the direction of N. 65° W. The attack on the caravan was quite unprovoked, as, with the exception of the party seen on the Yangtse (and this on the opposite bank), no inhabitants had been met with throughout. The authority of the Kuku-nor mandarin is but feebly exercised, and as this functionary had himself proved far from friendly, there was little chance of redress.

AFRICA.

The Livingstone Memorial.—We have received, through the courtesy of the British South Africa Company, the copy of a plan, showing the extent and position of a rectangular plot reserved for the Livingstone memorial, near Old Chitambo's village, south-east of the swamps of Bangweulu. Each side measures 210 feet, giving an area of just over an acre, and the four corners have been marked by beacons. The position is shown as about 3 miles south of the Lulimala river, in 12° 18½′ S. lat., 30° 21′ E. long.

British East Africa.—The Annual Colonial Report for 1905–6 (No. 519) on the East Africa Protectorate estimates the population, at variance from the estimate of the previous year's report, at nearer four than two millions. Parts of the Kenya province have been found to be very densely inhabited. The white population (March 31, 1906) numbered 1813, 264 being Government officials. Among the European population were 38 births and 26 deaths. Normal conditions of health

prevailed in the protectorate. The immigrants included 1861 Europeans and 6454 Asiatics and Africans; the emigrants 1427 of the former, and 6724 of the latter. Work is plentiful, food cheap, and taxes light for the natives. During 1905 land grants amounting to 549,828 acres were made, as against 197,256 acres in 1904. In 1905–6 the total area surveyed amounted to 745,530 acres, against 618,542 acres in 1904–5. The survey of Lake Victoria is practically completed, and useful charts are in preparation. Fifty-three miles of telegraph line have been added in 1905-6, making a total mileage of 2167 miles. An ordinance prohibits possessing and trading in cow ivory and the tusks of immature bull elephants. The highest recorded temperature, 95°, was registered at Makindu on April 3; the lowest, 40°, at Naivasha on June 22. Of all places in the protectorate Nandi had the maximum rainfall in 1905, 99·08 inches, made up by 150 days' rain, 16·7 inches falling in March. At Shimoni 27·12 inches fell in March. In 1905 only 15·81 inches fell at Kismayu, where no rain fell in January, September, and December, there being only 28 days of rain throughout the year. The maximum rainfall on one day, 4·72 inches, occurred at Mombasa on May 9. The yearly average of rainfall for ten years (1896–1905) at Kismayu was 14·78 inches, the maximum in that period, 20·52 inches, being reached in 1902, and the minimum, 6·68 inches, in 1903. The report includes special reports on experimental farms, return of land, industrial, and mining concessions, etc. Altogether, it is one which may be read with solid satisfaction.

The Congo Railways.—An article, with map, in the *Mouvement Géographique* (1907, No. 12) considers the position of the Congo State in respect of railways. The line from Matadi to Stanley Pool was opened in 1898, and in September, 1906, the line from Stanleyville to Ponthierville, carrying with it the utilization of the stretch from Ponthierville to Lumbulumbu. The laying of a railway from Lumbulumbu to Hell Gate, over 180 miles, has been begun, and is expected to be completed by the end of 1910. Before that time the 400-mile section, Hell Gate to Kalengwe, will be taken in hand. Thence to the mines of Katanga there are 150 to 200 miles of line to lay, a work which should take three years—*i.e.* to the end of 1913. But by that date the English railways from Rhodesia and Lobito bay will already connect the Katanga region with the sea. In a year or a year and a half the Rhodesian line will reach Kansanshi, and by the end of 1909 might arrive at the mines of Kambove and Ruwe, enabling Upper Katanga to export its metals by Beira. From Lobito bay, again, the Benguela rail is being laid over the first 200 miles, and might be at the Katanga mines in 1913. The Rhodesian railway should, therefore, serve the mines long before that from Benguela. The latter will, however, not cover more than 900 miles, whereas the Kambove-Beira line is well on towards 1700 miles. To forestall the Benguela railway, and divert the mining traffic to the Congo lines, the article urges the propriety and feasibility of having the lines from Lumbulumbu to Kalengwe available for traffic within four years, and of fixing the railway tariffs at low rates. A new route is suggested by way of the Kasai, the Sankuru, and a 300-mile line from Lusambo to Hell Gate.

AMERICA.

The Trade of Newfoundland.—An official "Report on the Foreign Trade and Commerce of Newfoundland, 1905–6," shows that the commercial progress of the colony continues to be well maintained. The total external trade in 1905–6, equalling over £20 per head of a population of 230,000, marks an advance of 116 per cent. on that of 1897–8. During the last seven years the balance of exports over imports totals over eight million dollars. The powerful markets nearer home are, however, steadily withdrawing the trade of the colony from the United Kingdom. Engrossing

38 per cent. of the Newfoundland trade in 1888, Britain's share in 1905–6 had fallen to 19·2 per cent. Simultaneously with a shrinkage of 23½ per cent. in the United Kingdom's total trade with Newfoundland from 1888 to 1905–6, Canada increased her trade 106·2 per cent., and the United States 150·4 per cent. From the first place as an importer into the colony the United Kingdom has dropped to a bad third, Canada also having fallen behind the United States in 1905–6. Distilling no spirits, Newfoundland imports only 0·354 of a gallon per head, by legitimate channels at least. Among the imports of 1905–6, 3½ million dollars are set down to farm products—a very considerable part of which might be produced at home. Possessing minerals and valuable forests, the land is credited with excellent pasture and vegetables, and (probably) the ability to mature cereals. Its dominating characteristic, however, continues to be its codfishery, which for centuries has been a bone of contention to rival nations. The fishery still rises steadily in value. During the four years ending 1905–6, the products of the cod fishery made up 65·9 per cent. of the total exports, and in 1905–6, 68 per cent. Good and bad series of years seem to alternate in irregular cycles. Thus eight fat years, 1879–86, were followed by eight lean years, 1887–94. During the last four years there has been a serious falling off in the Bank fishery. The Bank has long been prized by foreign nations, not only as a fishing-ground but also as a training ground for seamen. Rather than permanently employ them in the navy, France has preferred paying large bounties to her Bank fishermen. The revolution, however, in the working of modern ships of war seriously reduces the value of the Bank as a seamen's training school. To Newfoundland itself may therefore before long be resigned her proper geographical share in the Bank fishery.

Natural Mounds in the United States.—Attention was called in the *Journal* for August, 1905, to a discussion which had been carried on in the pages of *Science* respecting the small mounds which form so characteristic a feature in various parts of the United States, particularly in the plains of the region bordering the Gulf of Mexico. The discussion has since been continued, both in *Science* and other publications, without any general agreement being arrived at regarding the cause of the phenomenon. In connection with this discussion, Prof. W. H. Hobbs, who has lately made some valuable contributions to the study of earthquakes, calls attention, in the *American Journal of Science* for April, 1907, to the important part which may be played by earthquake shocks as a contributory cause of some, at least, of such mounds. After noting that one observer, Mr. A. C. Veatch, lays stress on the difference in the composition of the mounds from that of the surrounding ground, he points out that the Gulf plain region is one of notable seismicity, and that sand and water fountains, as well as mud volcanoes, with their products —sand or mud cones and craterlets—are almost universally produced in connection with great earthquakes. The immediate cause is, he points out, the extensive derangement of the ground water during earthquakes, a subject which has not yet received the attention it deserves. On the theory that earthquakes are associated with the displacement of crustal blocks or compartments, a natural result of an earthquake will be the squeezing out of water from the trunk channels of circulation within those districts where blocks are depressed—the contrary movement leading to a sucking down of the water. Among other phenomena of a parallel character, instances are quoted of the formation of funnel-shaped pipes of sand brought up from lower levels, or of sandstone dykes where the material has welled up through the entire length of a fissure. The mud-lumps constantly forming in the Mississippi delta are ascribed to a similar cause, while the so-called mud volcanoes of Minbu and elsewhere are held to be another instance of the same action, having really very little in common with volcanic phenomena. Prof. Hobbs

believes that wherever sand or mud cones are now forming, orographic blocks are being depressed, as is frequently the case at the deltas of great rivers. The Gulf plain mounds are probably aligned upon underground fissures and their intersections, and their more careful mapping may throw some new light on the hidden fissure-system in that region. In connection with Prof. Hobbs's paper, reference may be made to Mr. Schwarz's note on 'Natural Mounds in Cape Colony' (*Journal*, January, 1906). In this case the same difference in composition between the mounds and the neighbouring areas is recorded, while the observation of many sand fountains suggested to the writer a possible aqueous origin for the hillocks.

Structure of the Mexican Plateau.—Mr. R. T. Hill gives some notes on the tectonic history of the Mexican Plateau while describing, in *Science* for May 3, 1907, the geology of the Sierra Almoloya—a long, narrow range rising 1500 feet above the surrounding plain, or 6500 feet above the sea. This sierra consists mainly of stratified limestones of Lower Cretaceous age, which have been greatly tilted and thrown into a most complicated system of folds, though, taken as a whole, the strata dip conformably with the slope in every direction, giving the range a quaquaversal character. It is a destructional or decadent form of mountain, revealing the ancient wrinkled and folded character of the plateau before it was buried by the vast volcanic outpourings which once covered the whole of this part of Mexico. The limestones are in places completely metamorphosed and are now excessively fractured, two distinct systems of faulting being discernible. Mr. Hill traces two corresponding periods in the geological history of the region: the first at the close of the Cretaceous period, at the time of the great Rocky mountain uplift and union of the North and South American continents, when the trend of the folds and faults was north-east or from north to south; the other probably during the Miocene epoch, when the great volcanic ejections took place, the whole structural trend now changing to N. 40° W. It was during this second period that the great mineral lodes of Mexico were mostly intruded, through the medium of hot vapours, waters, and gases, up the north-westerly fault-zones. It appears as though the whole of this region has been the site of the crux of two distinct periods of mountain-making movements, and by the hypothesis of the crossing of the two belts of deformation many hitherto obscure phenomena of the continent may be explained. Further study, Mr. Hill thinks, may show that the post-Miocene belt of north-west to south-east movement may extend from California across Mexico, and connect with the Antillean movements of the West Indies.

Mexican Isthmus Railway.—A Consular Report (Miscellaneous Series, No. 658) treats of the history, present position, and probable prospects and bearing on the commerce of the world, of the Tehuantepec railway and its two terminal harbours opened for traffic last January. The work on the harbours will probably not be finally concluded till 1909. Yet, like the railway, apparently of the most solid workmanship, they are so far advanced as to admit of the entrance of large ships, and the speedy handling of freight. From port to port it is only 125 miles in a bee-line, but the route followed by the railway covers 190 miles. From the mouth of the Coatzacoalcos the railway gradually ascends till, at 79 miles, it shoots over the steel bridge, 560 feet long, spanning the Jaltepec river. Thence, by a steeper gradient, it runs 38 miles to Malatengo cañyon. Here the route is through rock cuts and bridged chasms, climbing to Rincon Antonio, 900 feet high, a healthy spot, where the company's yard and shops are established. Next the Chevela pass, 735 feet high, is crossed by gradients reaching 116 feet to the mile. The descent thence to the Pacific includes the steepest gradients. Following for some distance the course of the Tehuantepec river, the route leaves it before its terminus at Salina Cruzo. Connected with Vera Cruz and the Pacific railroad, the

railway gives access to all parts of the Republic, and to the United States, while its junction with the Pan-American line will give direct railway access to the Central American Republics. The magnitude of the influence likely to be exerted by the new railway on the highways of the world's commerce may be gathered from a table, embodied in the report, of comparative distances of the various routes from the principal ports of Europe and the United States to ports on the Pacific. The distance, *e.g.*, from New York to Hong Kong is 1351 miles, and to San Francisco 1200 miles, shorter by the new railway than by way of Panama.

AUSTRALASIA AND PACIFIC.

A Visit to the Ke Islands.—Captain Pim, one of the members of the Daniels ethnographical expedition to New Guinea, has lately made a trip to the little-visited Ke group, some notes on which, mainly of ethnographical interest, he has communicated to Dr. Seligmann, who has kindly placed the letter at our disposal. The writer had been engaged in "shelling" for a commercial company in the neighbourhood of the Aru group, whence he found it necessary to proceed on business to Ke. Rounding the south point of the principal island he coasted as near to the shore reef as possible to Ellat, the headquarters of the Dutch "Post-holder." Many little villages were passed, between which good roads had been cut over the rocky points which separated them. The hills and mountains (apparently limestone) were clothed with the most luxuriant vegetation, no patches of barren ground being seen. Ellat is the seat of a native pottery industry, supposed to have been brought hither generations ago by fugitives from Banda. Here the people were mostly of Malay blood, but Captain Pim made an excursion to an inland village on the south-east or windward side of the island, where the people were of Papuan race. The path was exceedingly rough, and the village was placed on a precipitous hill some 1000 feet above the sea. *En route* some "tabu" marks were seen recalling those in use at Waima, in New Guinea, and a couple of parallel stone walls were passed which were said in old days to mark a strip of neutral ground between two clans or tribes. At one part of the ascent of the hill a rude flight of steps had been constructed of flat stones, some of great size, and the central part of the village itself was surrounded by a wall of from 14 to 20 feet in height, admittance being through an opening reached by a wooden ladder. Captain Pim found the people preparing a coffin from the trunk of a tree split in two, the workmanship (performed by the help of adzes, axes, and a sort of draw-knife) was remarkably neat. The clothing of most of the people was only the mat of native manufacture, such as is seen in parts of New Guinea, and even this seems only to have been adopted of late years, though both men and women wear many ornaments. The hair was long, and frizzled after the New Guinea fashion, but two distinct types, one stiff and wiry, the other softer and longer, were noticed. The people seemed to be agriculturists, and the matriarchal system prevails among them. Captain Pim hopes to revisit the group after improving his knowledge of Malay, having been much hampered by the want of a suitable interpreter.

POLAR REGIONS.

The Wellman Airship Expedition.—Mr. Wellman left London on May 24 *en route* for Spitsbergen, whence he hopes this year to start on his adventurous airship voyage for the north pole. He was to collect his party at Tromsoe, sailing thence in the *Frithjof* early in June, and hoped, after preliminary trials, to make the final start towards the end of July, or early in August. The airship, which had preceded him to Tromsoe, has been subjected to some alterations since last year. The balloon has been made 18 feet longer, and now measures 184 feet in

length by 52 feet at its greatest diameter, with a total lifting force of 19,500 lbs. Arrangements have been made to use the surplus hydrogen gas, which is usually allowed to escape, as a subsidiary fuel-supply for the motor; and another novel device is that of a leather trailing-rope, 15 inches in diameter and 130 feet long, which can be packed with 1200 lbs. of reserve food. Altogether, the party takes supplies for ten months, and has with it twelve dogs, with sledges and small boats for use in case the voyage has to be interrupted. Mr. Wellman is again accompanied by Major Hearsey, lent by the United States Government as scientific observer, while the navigator is Felix Reisenberg, who spent last winter at the base in Spitsbergen with two Norwegian companions.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Ice and River Erosion.—Prof. Brunhes, one of the younger French geographers who has lately become known for several useful pieces of research work, has contributed one or two notes to the *Comptes Rendus* of the Paris Academy of Sciences on the subject of glacial, as compared with other forms of erosion. In one of these (*C.R.*, June 5, 1906), he laid stress on the special action of the sub-glacial streams which tends to make itself most felt at the two sides of the glacier-bed, thus favouring the production of the typical U-shaped section. In a more recent note (*C.R.*, April 29, 1907) he insists on the close analogy which is displayed, in spite of the general belief to the contrary, between the morphological features of glaciated and stream-eroded valleys, so long as the latter are in a youthful stage of development. Thus, while it is often said that water can only move on the down grade, while ice can surmount obstacles, he points out that the distinction is far less important than is supposed. In the case of a hollow excavated by a river in the concave part of its bend, this is not filled with stagnant water, but is only maintained by the scouring of its bed by the current, the water afterwards mounting the up-grade in its further course. The steps in the longitudinal profile of a glacial valley, the closed contours, the U-shaped section, and even the want of accordance at the junction of tributary valleys, are all to be matched in the case of erosion by running water if we consider the form, not of the water-surface, but of the ground fashioned by the water. The fall of the Rhone water into the general mass of the Lake of Geneva at the extremity of its delta is, Prof. Brunhes shows, but the expression and result of a veritable "Mündungstufe." He has elsewhere insisted on the importance of whirlpool action in water-erosion, and it is just this which is lacking in the case of ice, though present in the sub-glacial streams.

The Idea of Direction in Relation to Rivers.—It is evident that the idea of direction, applied to the course of a river as a whole, must be more or less indefinite and capable of various special interpretations, the only direction that is definitely fixed being that in a straight line from the main source to the main mouth. In a paper in the *Rivista Geografica Italiana* for February, 1907, Prof. A. Issel makes some suggestions with a view to the acceptance by geographers of certain conventions in respect to the direction of rivers, which, he thinks, may be of use in comparing the course of a river with the structural lines of its basin, or similar studies. He proposes the three terms "absolute," "dominant," and "mean direction" to denote (1) the direction from source to mouth of a river; (2) the direction which occurs most frequently during the windings of its course; (3) the mean of the partial directions obtained by dividing up the course of the river into small equal sections. This last is found by taking the diameter of the parallelogram constructed with a pair of partial directions as adjacent sides (the lengths being determined by the comparative frequency of the given directions), and using

this in combination with a third partial direction, and so on. In order to simplify the process, Prof. Issel reduces all the partial directions to definite points of the compass—sixteen or thirty-two according to the degree of accuracy required—and he shows the results diagrammatically by the help of a compass-rose, on which the directions and their comparative frequency are shown by a series of radiating lines of varying lengths. As partial directions of one and the same stream may in certain cases be exactly opposite, it may be impossible to obtain a single "mean direction," and the writer therefore determines a series of mean directions corresponding to the four quadrants of the circle, which, however, will rarely be all represented in one special case. The extent to which the arbitrary element enters into the method is recognized by the writer. Thus very varying results are obtained according to the scale of the map employed, and the degree of minuteness to which the division into segments is carried; and it is suggested that terms should be employed to indicate the degree of accuracy obtained. It may be noted that much will also depend on the width of the river under examination, for it is evident that in the case of a wide river, fewer curves will be missed in a small-scale map than when the stream is narrow. Even if some such system may be of use for the comparative purpose above alluded to, it may be doubted whether any instructive result can be gained by dealing at once with the whole course of rivers (such, *e.g.*, as the Nile or Brahmaputra), which traverse great distances, and cross regions of varying structure and characteristics. The paper is illustrated by a number of diagrams constructed to represent the various directions of the Arno, but there are one or two points not fully explained. Thus, it is puzzling to find the "absolute direction" of the river given as one point north of east (which is that from the *mouth* to the *source*), with the comment that it is almost the reverse of the "dominant" direction. Again, we find a diagram in which no fewer than ten "dominant directions" are shown, some of them entirely unrepresented in the rose of partial directions shown in juxtaposition. The writer makes no attempt to work out a comparison between river-directions and other features, beyond pointing out that in one case the mean directions of the Arno work out as three in number, two exactly opposite and corresponding with the main Apennine water-parting, the third at right angles to this.

GENERAL.

Dr. Krause as Geographer.—The position of geography in Germany in the early part of last century is illustrated by a monograph by Dr. A. Köhler (Leipzig, 1905), summing up and criticizing the geographical views of Dr. C. C. F. Krause. A notable scholar, Dr. Krause, thanks to his unpractical ways and the opposition he provoked, did not succeed in obtaining a professorship, but from 1802 to the end of his life had to work on the scant economic basis of the office of *Privatdocent.* More appreciated after his death, fifty volumes of his works have now appeared, and apparently the task is not quite completed. For an adequate representation of geography as conceived and formulated by Krause the reader must consult the monograph of ninety-four pages. Geography was not Krause's speciality, and the writer recognizes that, in this field, he produced nothing strikingly original; but, following up the ideas of Kant, Schelling, and Herder, was reproductive more than productive. He was, above all, a philosopher, bent on reducing everything to first principles. He inclines, therefore, to impose on geography the method and terminology proper to philosophy. Aspiring after a "primitive German" terminology, his nomenclature is imperfectly intelligible even to Germans. Yet idealizing geography, he exercised a not inconsiderable quickening influence on the science, and scattered among his writings are shrewd geographical intuitions.

For Krause geography is a natural science, and an independent one, requiring, however, for its comprehension a knowledge, among other things, of political history, and of the reciprocal history of the Earth and Man. He is said to have been the first to recognize Europe as a mere peninsula of Asia. He also pointed out the correspondence between Italy and Sicily on one side, and Great Britain and Ireland on the other.

OBITUARY.

Sir Dietrich Brandis, F.R.S.

The Society has lost a Fellow of forty years' standing in Sir Dietrich Brandis, well known for his excellent work in connection with forestry in India. The son of Dr. Christian Brandis, a professor at Bonn University, he was educated at Copenhagen, Göttingen, and Bonn, at which last university he became lecturer on botany in 1849. In 1856 he entered the Indian Forest Service, and soon did good work as superintendent of the forests of Burma. In 1864 he became Inspector-General of the Forests of India, a post which he continued to fill until his retirement in 1883. Since that date he continued to take a warm interest in everything connected with Indian forestry, the cause of which he furthered both by his writings and in connection with the forestry school of Cooper's Hill. Only last year he brought out an excellent handbook on Indian trees, intended primarily as an aid to forest officers in the task of making themselves acquainted with the trees under their charge. The preparation of this had involved a large amount of work, rendered more trying by the author's advanced age and failing health. He died on May 28, after six months' illness, at his old home of Bonn on the Rhine, aged eighty-three years.

Dr. E. J. Routh, F.R.S.

The well-known Cambridge tutor, Dr. E. J. Routh, whose pupils so many of the senior wranglers of the latter half of the nineteenth century were proud to avow themselves, died early in June at Cambridge, where he had continued to live after his retirement from work as a teacher in 1890. He had joined our Society in 1864, and had thus been a Fellow for no less than forty-three years. He was a man of wide interests, not by any means confining his attention to his own particular subject, and his sympathy was always with the efforts of the Society to improve the position of geographical education in this country, especially at his own University. Dr. Routh was born in Canada in 1831, being the son of Sir Randolph Routh, Commissary-General to the Forces in the Dominion. He came to this country at an early age, and was educated at University College, London, and Peterhouse, Cambridge, of which college he became a Fellow after appearing at the head of the Mathematical Tripos in 1854.

Captain J. Buchan Telfer, R.N., F.S.A.

We regret to record the death, at the age of seventy-six, of Captain J. B. Telfer, R.N., who had been a Fellow of the Society since 1875. Captain Telfer had seen much naval service, having taken part in the Crimean war (gaining the Baltic medal), besides serving on many of the naval stations abroad.

He subsequently married a Russian lady, and resided, about 1870, for three years in Russia, visiting on two occasions the Crimea and the Caucasus, and making extensive journeys through the mountain districts. His knowledge of Russia, and

his antiquarian and historical tastes, enabled him to add largely to the account of Suanetia previously given in Mr. Freshfield's 'Central Caucasus.' His work in two volumes, 'The Crimea and Transcaucasia,' published in 1875, has a permanent value as a mine of curious information and an accurate description of Transcaucasia at that date.

OBITUARY OF THE YEAR.

The following is a list of the Fellows who have died during the year 1906–1907 (April 30):—

T. E. L. Alldridge; A. Alexander; Lord Allandale; Rev. Chas. J. Armistead; Claude L. Barrow; Captain Maurice D. Bell; P. W. Braybrooke; Clifford J. Brookes; E. W. Briggs; Count De Bylandt; Captain W. E. Bentley; Sir Richard Couch; J. R. Cossar; Donald Cameron; H. W. Chubb; J. W. Carillon; H. W. Cadoux; Rev. J. J. Curling; J. A. Campbell; Rev. Dr. J. N. Cushing; Count H. Coudenhove; G. H. Drew; D. R. Dickson; K. Dunbar-Anderson; Colonel E. S. Daniel; F. G. S. De Wesselow; G. E. Dodson; John Dickson; G. F. Edwards; Robert Edleston; Captain H. C. Keith Fraser; Sir John Forbes; Admiral Sir E. Fanshawe; R. I. Fennimore; Rev. G. Grenfell; J. S. Greenhalgh; Lord Goschen; George Gordon; W. T. Hansford; R. A. Hankey; Edward Herdman; A. F. Howard; J. Stewart Hodgson; Arthur F. Herbert; David Hepburn; C. Kennerley Hall; J. F. Jones; John Jupe; Mrs. E. P. Jackson; James Irvine; H. R. Knott; G. B. C. Leveson; Major E. Le Mesurier; The Earl of Liverpool; G. J. L. Litton; William Marshall; John Moore; Sir Walter Morgan; Basil Martineau; Captain D. Mainland; W. R. McConnell; Ivan A. Morris; J. G. Don Marshall; W. A. Mitchell; F. A. Morgan; Rev. Canon Maccoll; Colonel Iles Matthews; Sir Hugh Nelson; Rev. J. O. Oxland; John Prince; Inspector-General E. R. H. Pollard; Henry Prince; Sir F. Plunkett; Lord Penrhyn; J. A. O. Payne; J. Grafton Ross; Major F. I. Ricarde-Seaver; F. W. Raikes; James Holland Robertson; M. A. Raquez; Colonel F. R. Waldo-Sibthorp; Admiral Sir F. W. Sullivan; W. H. Stuart; Rev. Dr. James Stewart; General Sir H. A. Smyth; T. Valentine Smith; Colonel C. F. Surtees; Christopher Barker Smith; W. J. J. Spry; Robert Scott; Horace Smith-Bosanquet; Robert Taylor; Sir H. E. L. Thuillier; W. A. Tully; Sir R. Tangye; Lord Thring; Admiral Sir R. Tracey; James Vavasseur; Dr. C. R. Walker; Rev. F. A. Walker; Alfred Williams; John Weise; Stephen White; Allan Wyon; W. Clarence Watson.

CORRESPONDENCE.

Levels of African Lakes.

Entebbe, April 29, 1907.

In connection with a recent paper read by Lieut. Behrens, R.E., before the R.G.S. on the levels of African lakes, it may be of interest to inform you that a complete chain of levels was run with 16-inch dumpy level between Lakes Victoria and Albert by one of the surveyors of this department (Mr. E. Richardson) some months ago, and this gave a difference of level to the nearest foot between the lakes of 1692 feet. As only one observer was employed, and no check levels were run, the figures are not absolutely reliable, but are more so than any previous figures I have seen.

Raymond E. Allen, F.R.G.S., Ch. Surveyor, U.P.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1906–1907.

Anniversary Meeting, May 27, 1907.—The Right Hon. Sir GEORGE TAUBMAN GOLDIE, K.C.M.G., F.R.S., D.C.L., LL.D., in the Chair.

THE Secretary read the Minutes of the last Anniversary Meeting, which were confirmed and signed by the President.

The Secretary read a list of the newly elected Fellows, and announced that there were five candidates for election.

ELECTIONS. — *William Delabere Barnes; Charles Edward Moss; E. R. Murphy; Basil Tanfield Beridge Boothby; Major E. P. Brooker, R.E.; Douglas Graham Campbell; Lieut.-Colonel John Lloyd Dickin; Dennys Drake; Ernest John Edwards; Ernest Alfred Glanville; Captain C. W. Gordon* (*5th Fusiliers*)*; M. Y. Hsu, B.A.; Colmer William Donald Lynch; John William Page; George Roger; Vivian Lee Osborne Sheppard; Philip Small; Captain Maurice E. Sowerby, R.E.; Rev. Chas. Edward Wilson; F. R. Wollaston; John Wm. Young.*

THE PRESENTATION OF THE MEDALS AND OTHER AWARDS.

The PRESIDENT: Dr. Francisco Moreno, to whom has been awarded the Founder's Gold Medal, expected to have been able to come here from South America and receive it himself, but at the last moment he was prevented from doing so, and he sent a cablegram to that effect. The Argentine Minister has been good enough to ask his brother, Sr. D. Carlos Diminguez, who is a member of the Legation, to attend here and receive it on behalf of his brother. I will read the minute of the Council on the award of the Medal—

"Dr. Francisco Moreno is one of the foremost scientific geographers of the day. For more than twenty years he has been personally occupied in the work of South American exploration. Patagonia and the Southern Andes have been his peculiar field, and in the prosecution of his work in the field he has encountered unusual risks, having been captured by the Indians once, and barely escaping with his life. As a scientist his reputation is European. He was the expert employed by the Argentine Government on the Chile-Argentine boundary question, and it is to him that we owe nearly all our knowledge of the physical geography of the extreme south of South America. He still continues his active interest in all geographical enterprise. He has now a geographical school under him, and they are studying the science very thoroughly."

Sr. CARLOS M. DOMINGUEZ: I have been deputed by the Argentine Minister, who is unavoidably prevented from attending the afternoon meeting, to receive, on behalf of Dr. Don Francisco P. Moreno, the Royal Founder's Medal, with which he has been honoured by the Council of the Society. Dr. Moreno wishes me to express his heartfelt thanks to this Society for such great distinction bestowed upon him; and, if I may be allowed, I desire to add, as an Argentine citizen, the gratification of my compatriots in seeing a fellow-countryman so highly honoured by the premier geographers of the world.

The PRESIDENT: His Excellency, the Norwegian Minister, Dr. Nansen, has been good enough to undertake to transmit to Captain Amundsen the Patron's Gold Medal, which was awarded to him by the Council.

Your Excellency, I will read to you the Minute of the Council on which they based the award to Captain Amundsen, although I am quite sure you could tell us very much better what Captain Amundsen has done—

"Captain Amundsen went first on a sealing expedition to the Arctic Regions, to

learn navigation and to prepare himself for Arctic exploration. He then served as first lieutenant on board the *Belgica* in the Belgian Antarctic Expedition. On his return he devoted himself to master the subject of terrestrial magnetism, placing himself under the tuition of Dr. von Neumayer, of the Hamburg Observatory, in order that he might qualify himself for his projected work around the north magnetic pole. After purchasing his ship, the *Gjöa*, he spent some time exploring the ocean between Spitsbergen and Greenland, making valuable contributions to oceanography, which have since been worked out by Dr. Nansen. He sailed for the region around the north magnetic pole in 1903, in his small ship, with eight men all told, all of them more or less specialists. He devoted two years to careful observations, with the best instruments, round the north magnetic pole, making contributions of the first order to our knowledge of geographical distribution of magnetism. During the stay of the expedition in the neighbourhood of Boothia, several expeditions were made in various directions. A large section, hitherto unmapped, of the North American coast was mapped, and much other geographical work done in the neighbouring islands, and careful observations were made on the Eskimo, among whom the expedition lived. At the conclusion of the magnetic work the little ship was taken out by Behring straits, and thus for the first time the North-West Passage was completed in a vessel. Altogether, Captain Amundsen deserves to be placed in the first rank as a scientific discoverer."

His Excellency Dr. NANSEN: I have to regret deeply that Captain Amundsen was not able to be present here to-day in order to receive this great honour in person. He has asked me to do it in his place, and to express his deep gratitude for the great distinction which has been conferred upon him. I am thanking you in his name, and also on behalf of my own country, for this distinction, coming from an institution of a country which has done nearly all the exploring work in that region where he went just to give the finishing touch. It was you who first discovered the magnetic north pole; from you we have all the knowledge of those important regions; but I hope the fact that a Norwegian was allowed to complete the work more or less is a new tie between the country which I have the honour to represent and your own great empire. I again thank you on behalf of Captain Amundsen and on behalf of Norway for the great honour you have bestowed upon him.

The PRESIDENT: The Murchison Award for 1907 was made to Major C. E. Smith, R.E., for his various important surveys in British East Africa, carried out with admirable efficiency. Major Smith, as many of you know, has returned to Africa on very important survey work, so that he is not able to receive it himself, but I understand that one of his brothers is willing to receive it for him. I now have the honour to present the award.

Mr. A. H. SMITH: My brother, as you have said, is far out of reach of this meeting. He is back in the East Africa Protectorate, carrying on the work which he did in previous years, and I can assure you it is a great encouragement to him in his work to know it is approved by the skilled judgment of this Society. He highly appreciates the honour, and I beg to tender his sincere thanks.

The PRESIDENT: Mr. Raymond Beazley, the Gill Memorial for 1907 is awarded to you for your work in three volumes on the 'Dawn of Modern Geography,' the results of many years' research, at your own expense, into the progress of geography and exploration from the early centuries of the Christian era down to the Middle Ages. The work will be of permanent value to all students of geography.

Mr. RAYMOND BEAZLEY: I can hardly say how much an honour of this sort encourages one who has, I hope, not finished his work in this field, to go and, if possible, to do better than he has done before. It has the sanction of that body in

the world which is most dear to my heart, and which most of all encourages me to try and go forward in the work that I have begun.

The President: Mr. Moss, the Back Bequest for 1907 has been awarded to you for your important researches on Geographical Distribution of Vegetation in England, as embodied in your paper on the "Peat Moors of the Pennines," in the *Journal* for 1904, and in a paper on the "Geographical Distribution of Vegetation in Somersetshire," with map, published as one of the extra publications of the Society. You carried out this work at your own expense during your holidays.

The President: Major C. W. Gwynn, you have been awarded the Cuthbert Peek Grant for 1907. In 1899-1900 you carried out an important survey expedition from Roseires, on the Blue Nile, in a southerly direction down to Sobat or Baro river. Between 1900-1901 you conducted an expedition yielding important geographical and cartographical results along the proposed Sudan-Abyssinian frontier.

The President then delivered his anniversary address (see p. 1).

After the visitors had withdrawn, the President appointed as scrutineers of the ballot for Council Mr. G. G. Chisholm and Mr. W. M. Corner.

The Report of the Council was then read; it will be published in the next Year-book.

The President: I have to announce on the report of the scrutineers that the lists sent round on the Council's recommendation have been accepted.

The list is as follows, the names of new members, or of those changing office, being printed in *italics*:—

President: Right Hon. Sir George D. Taubman Goldie, K.C.M.G., F.R.S., D.C.L., etc. *Vice-Presidents:* Sir H. E. G. Bulwer, G.C.M.G.; *Sir Harry H. Johnston*, G.C.M.G., K.C.B.; Right Hon. Lord Curzon of Kedleston, G.C.S.I., G.C.I.E., etc.; Douglas W. Freshfield; *Colonel Sir Colin C. Scott-Moncrieff*, R.E., K.C.M.G., K.C.S.I.; Sir Clements Markham, K.C.B., F.R.S., F.S.A. *Treasurer:* Edward L. Somers Cocks. *Trustees:* Right Hon. Lord Avebury, D.C.L., F.R.S.; Lord Belhaven and Stenton. *Hon. Secretaries:* Major Leonard Darwin, R.E.; *Colonel Sir D. A. Johnston*, K.C.M.G., C.B., R.E. *Foreign Secretary:* Sir John Kirk, K.C.B., G.C.M.G., F.R.S. *Councillors:* Admiral Sir Nathaniel Bowden-Smith, K.C.B.; *Colonel G. Earl Church*; Major Chas. F. Close, C.M.G., R.E.; *Sir Martin Conway*, M.A., F.S.A.; *Admiral A. Mostyn Field*, F.R.S.; *J. Stanley Gardiner*, M.A.; *Sir David Gill*, K.C.B., LL.D., F.R.S.; Sir Clement L. Hill, K.C.M.G., K.C.B., M.P.; Colonel Sir Thomas Hungerford Holdich, K.C.I.E., C.B., R.E.; *James F. Hughes*; Sir George S. Mackenzie, K.C.M.G., C.B.; Admiral Sir Albert Hastings Markham, K.C.B.; John L. Myres, M.A.; Right Hon. Sir J. West Ridgeway, G.C.M.G., K.C.B., K.C.S.I.; *Earl of Ronaldshay*; Howard Saunders, F.L.S.; *Dr. Aubrey Strahan*, F.R.S.; Colonel Hon. M. G. Talbot, R.E.; H. Yates Thompson; Professor W. W. Watts, F.R.S.; Colonel C. E. Yate, C.S.I., C.M.G.

THE ANNIVERSARY DINNER.

The Anniversary Dinner took place in the evening at the Whitehall Rooms of the Hôtel Métropole. Sir George Goldie, the President, was in the chair, and among those present were the American ambassador, the Italian ambassador, the Argentine minister, the Norwegian minister, the Vice-Chancellor of Oxford, the Vice-Chancellor of Cambridge, the Principal of the University of London, Sir J. West Ridgeway, General Sir Reginald Talbot, General Sir Frederick D. Lugard, General Sir A. Lyttelton-Annesley, the Earl of Camperdown, Admiral Hon. Sir E. R. Fremantle, the Premier of Victoria, Sir Colin Scott Moncrieff, Lord Eustace Cecil, Sir Harry Johnston, Admiral Sir Albert Markham, Sir Thomas H. Holdich, Sir Henry E. G. Bulwer, Admiral A. Mostyn Field, Admiral Sir N. Bowden Smith, Sir George S. Mackenzie, Hon. George Peel, Sir Henry Trotter, Sir Thomas Fowell

Buxton, General Sir Edward Hutton, Sir James Hayes Sadler, Mr. Yates Thompson, Dr. H. H. Guillemard, General Shaw-Stewart, General J. C. Dalton, Mr. D. G. Hogarth, Mr. J. L. Myres, Colonel G. E. Church, Captain H. G. Lyons, Sir Alfred Sharpe, Major Powell-Cotton, Lieut. Boyd Alexander, Dr. C. Chree, Colonel Sir Duncan Johnston, Mr. J. F. Hughes, Mr. E. L. S. Cocks.

After the toasts of "Our Patron, the King," and "Our Vice-Patron, the Prince of Wales," the PRESIDENT proposed the toast of "The Navy and the Army," to which Admiral the Hon. Sir E. R. Fremantle and General Sir A. Lyttelton Annesley replied.

The PRESIDENT then proposed the toast of "The British Empire," which was responded to by the Premier of Victoria, by Sir Frederick Lugard, Governor of Hong Kong, and by Mr. Frank Tate, Director of Education in Victoria.

The toast of "The Guests" was proposed by the PRESIDENT, and responded to by the Italian ambassador and the Vice-Chancellor of Oxford.

Sir THOMAS HOLDICH proposed the toast of "The Medallists," which was responded to by the Argentine minister and the Norwegian minister.

The toast of "The Society" was proposed by the Vice-Chancellor of Cambridge, and responded to by the PRESIDENT.

Fourteenth Meeting, June 10, 1907. The Right Hon. Sir GEORGE T. GOLDIE, K.C.M.G., D.C.L., LL.D., F.R.S., President, in the Chair.

The paper read was :—

"On the Influence of Ice-melting upon Oceanic Circulation." By Dr. Otto Pettersson.

Fifteenth Meeting, June 17, 1907. The Right Hon. Sir GEORGE T. GOLDIE, K.C.M.G., D.C.L., LL.D., F.R.S., President, in the Chair.

ELECTIONS.—*Henry Gloster Armstrong; Walter Samuel Ascola; Wm. Benstead; Ernest Francis Bowen; Charles Stewart Burnett; Frank Wright Cluny; Prof. G. C. Carrington-Craxton; Francis Hill Cobb; A. H. Gehrke; Major W. Gillman, D.S.O., R.A.; Herbert Le Gren Harrison; David Ernest Hutchins; Walter J. Jones; Major K. McLaren, D.S.O.; Malcolm Maclaren; Captain H. Walter G. Meyer Griffith; E. S. Morphew; Captain Henry George Charles Perry-Ayscouth (Inniskillen Fusiliers); William Peterson; Edward Arthur Read; Charles Henry Rosher; Malcolm Ross; David Dunn Stewart; W. M. Strong, M.A., M.D.; George Henry Tatterfield; Colonel Wentsai Shu Yun Tinge; Charles Hay Walker; Wilfred Watkins; Wm. Donald Paul Watson; Wm. Baker White; George Nigers Worthington, M.B., B.C., M.A.*

The paper read was :—

"In the Equatorial Forests of Africa." By Major P. H. G. Powell-Cotton.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full :—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k.k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps—Glaciation. **Nussbaum.**
Die eiszeitliche Vergletscherung des Saanegebietes. Inaugural-Dissertation . . . von Fritz Nussbaum. Bern, 1906. Size 9 × 6, pp. viii. and 230. *Maps and Sections. Presented by the Author.*

Austria—Bohemia. *M. k.k. G. Ges. Wien* 49 (1906): 586–593. **Sellner.**
Geomorphologische Probleme aus dem Hohen Böhmerwalde. Von Dr. Alois Sellner.

Baltic—Ice. *Fennia* 21 (1903-04): No. 1, pp. 170. **Heinrichs.**
Isförhållandena i Östersjön och dess vikar I. Makriel. Af Axel Heinrichs.

Belgium. *B.S. Belge Géologie* 20 (1906): *Mémoires*, 71–82. **Briquet.**
Contribution à l'étude des origines du réseau hydrographique du nord de la Belgique. Par A. Briquet. *With Sketch-maps.*

Central Europe—Hydrology. *G.Z.* 12 (1906): 611–630, 682–699. **Keller.**
Die Abflusserscheinung in Mittel-Europa. Von H. Keller. *With Diagram.*

Europe—Fisheries. ———
Conseil permanent international pour l'exploration de la mer. Bulletin statistique des pêches maritimes des pays du nord de l'Europe. Vol. 1. 1903 et 1904. Copenhagen, 1906. Size 10½ × 8½, pp. 262. *Charts.* [In English and German.]

Europe—Political. *J.R. Artillery* 33 (1906): 346–357. **Maguire.**
The rôle of Poland in modern Europe. By T. Miller Maguire. *With Maps.*

France—Brittany. *Ann. de G.* 15 (1906): 213–236, 299–328. **Martonne.**
La pénéplaine et les côtes bretonnes. Emm. de Martonne. *With Sketch-maps, Illustrations, and Sections.*

France—Nord. *B.S.G. Com. Paris* 28 (1907): 33–42. **Morael.**
Le littoral de la Flandre française : son avenir économique. Par Georges Morael.

Germany—Bavaria. **Messerschmidt.**
Sitzungsber. A.W. München 35 (1905): 69–83; 36 (1906): 545–579.
Magnetische Ortsbestimmungen in Bayern. Von J. B. Messerschmidt. *With Map.*

Germany—Prussian Saxony. *Abh. u. Ber. Museum Magdeburg* 1 (1905–06); 6–41. **Jacob.**
Die geographisch bedingten wirtschaftlichen Grundlagen der Magdeburger Gegend. Von T. Jacob. *With Map and Section.*

Greece—Ithaka. **Dörpfeld.**
Leukas: zwei Aufsätze über das homerische Ithaka. Von Wilhelm Dörpfeld. Athens, 1905. Size 9½ × 6½, pp. viii. and 44. *Maps. Price* 1*s.* 4*d.*

Hungary. **Shrubsole.**
Geographical errors in British school-books. By W. H. Shrubsole. London, 1907. Size 13 × 8, pp. 4. *Illustration.*

A protest chiefly directed against the prevalent confusion as to the political status of Hungary.

Hungary—Bihar mountains. **Szádeczky.**
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Gletscherspuren im Bihargebirge. Von Dr. J. Szádeczky. (*Földrajzi Közlemények.* **34** (1906): 2[illegible]–[illegible]4. *With Illustrations.*

Iceland. *G.Ts. K.Danske G.S.* **18** (1905–06): 283–287. **Jensen.**
Meddelelser om Generalstabens Arbejde paa Island i Sommeren 1906. Af Premierløjtnant P. F. Jensen. *With Illustrations.*

North Sea and Baltic. **Küppers**
Physikalische und mineralogisch-geologische Untersuchung von Bodenproblem aus Ost- und Nordsee. Von Dr. Ernst Küppers. Kiel, 1906. Size 12¾ × 10¼, pp. 12. *Maps.*

Norway—Ethnology. *Norske G.S. Aarbog* 17 (1905–06): 145–216. **Hansen.**
De ældste husformer i Norge. Af Dr. Andr. M. Hansen. *With Illustrations.*

Norway—Trondhjem—Avalanches. **Nissen.**
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Et sneskred i Sundalen. Af Peter L. Nissen. *With Illustrations.*

Russia—Archangel. *Iz. Imp. Russian G.S.* **41** (1905): 571–585. **Rudnev.**
Preliminary Report on the Bolshesemelsk Expedition, 1904. By D. Rudnev. *With Map and Illustrations.* [In Russian.]

Russia—Bibliography. **Friederichsen.**
Europäisches Russland 1894–1905 (mit Einschluss des Kaukasus und Russisch-Armeniens). Von Prof. Dr. Max Friederichsen. Size 8¾ × 5¼, pp. [60]. *Presented by the Author.*

Russia—Ladoga. *Iz. Imp. Russian G.S.* **41** (1905): 737–754, 755–763. **Hilsen.**
Examination of samples of soils from the southern and central parts of Lake Ladoga. By K. Hilsen. *With Map.*
Materials for the study of the rocks of Lake Ladoga. By the same. *With Maps.* [In Russian.]

Russia—Samara. *Iz. Imp. Russian G.S.* 41 (1905): 283–288. **Volarovich.**
Hypsometric work in the bay of Samara. By P. E. Volarovich. [In Russian.]

Russia—Urals. *Abrégé B.S. Hongroise G.* **34** (1906): 168–174. **Pápay.**
Die Ural-Karte Anton Reguly's. Von Josef Pápay. (*Földrajzi Közlemenyek* **34** (1906): 349–370. *With Map.*)

Reguly was one of the most meritorious pioneers in the Northern Urals. His map appeared in 1847.

Spain. **Hutton.**
The Cities of Spain. By Edward Hutton. London: Methuen & Co., [1906]. Size 9 × 5¾, pp. xvi. and 324. *Illustrations. Price 7s. 6d.*

Spain—Tarragona. *C.R.A. Sc., Paris* **143** (1906): 815–818. **Cirera.**
Détermination des coordonnées geographiques de Tortosa et du nouvel Observatoire del Ebro. Note de R. Cirera.

Sweden—Peat-moors. **Post.**
Norrländska Torfmossestudier I. Drag ur myrarnas utvecklingshistoria inom "lidernas region." Af Lennart von Post. (Meddelanden från Upsala Universitets Mineralogisk-Geologiska Institution, 30.) Stockholm, 1906. Size 8¾ × 5¾, pp. 199–308. *With Maps and Illustrations.*

Sweden—Stockholm. *Ymer* (1906): 273–292. **Larsson.**
Topografiska studier i Stockholmstrakten. Af Adolf Larsson. *With Sketch-maps, Illustrations, and Sections.*

United Kingdom. *Deutsche Rundschau G.* **29** (1906): 1–12, 62–71. **Kirchhoff.**
Die Britischen Inseln und die Briten. Von Prof. Dr. Alfred Kirchhoff.

United Kingdom. **Mackinder.**
Our own islands. An elementary study in geography. By H. J. Mackinder. London: G. Philip & Son, [1907.] Size 7¼ × 5, pp. xvi. and 298. *Maps and Illustrations. Price 2s. 6d. Presented by the Publishers.*

United Kingdom—England. **Pocock.**
Memoirs of the Geological Survey: England and Wales. Explanation of Sheet 110. The Geology of the Country around Macclesfield, Congleton, Crewe, and Middle-

wich. By S. I. Pocock. London, 1906. Size 9½ × 6, pp. vi. and 138. *Sketch-maps and Sections.*

United Kingdom—Glacial Epoch. **Lamplugh.**

British Association for the Advancement of Science: York, 1906. Address to the Geological Section by G. W. Lamplugh, President. On British Drifts and the Interglacial Problem. [London, 1906.] Size 8½ × 5½, pp. 28.

United Kingdom—Scilly Isles. **Barrow.**

Memoirs of the Geological Survey: England and Wales. Explanation of sheets 357 and 360. The Geology of the Isles of Scilly. By George Barrow. London, 1906. Size 9½ × 6, pp. iv. and 38. *Map and Illustrations.*

United Kingdom—Scotland—Lakes. **Chrystal and Murray.**

An Investigation of the Seiches of Loch Earn by the Scottish Lake Survey. Part I. Limnographic Instruments and Methods of Observation. By Prof. G. Chrystal. Part II. Preliminary Limnographic Observations on Loch Earn. By James Murray. (From the Transactions of the Royal Society of Edinburgh, vol. 45, part ii.) Edinburgh, 1906. Size 12 × 9½, pp. [36]. *With Illustrations and Diagrams.*

United Kingdom—Scotland—Perthshire. **Rodger.**

Illustrated Handbook to the Perthshire Natural History Museum, and Brief Guide to the Animals, Plants, and Rocks of the County. By Alex. M. Rodger. Perth, 1906. Size 7 × 5, pp. 88. *Sketch-map, Illustrations, and Sections. Price 3d. Presented by the Curator, Perthshire Museum.*

Western Europe—Erratics. **Wichmann.**

K.A.W. Amsterdam, P. Sect. Sc. **8** (1905-6): 518-535.

On fragments of rocks from the Ardennes found in the Diluvium of the Netherlands North of the Rhine. By Prof. A. Wichmann. *With Map.*

ASIA.

Aden and Perim. **Bartet.**

Souvenirs de croisière dans la mer Rouge. Notes géographiques et historiques sur Aden et Périm. Par le Dr. Bartet. (Extrait du Bull. de la Société de Géographie de Rochefort, 1904.) Rochefort, 1904. Size 10 × 6½, pp. 116. *Presented by the Author.*

Armenia. **Zahn.**

Veröffentl. I. f. Meeresk. u.d. G.I., Universität Berlin, Heft **10** (1906): pp. viii. and 90.

Die Stellung Armeniens im Gebirgsbau von Vorderasien, unter besonderer Berücksichtigung der türkischen Teile. Von Dr. Gustav W. v. Zahn. *With Maps.*

Central Asia—Tian-Shan. **Keidel.**

Geologische Untersuchungen im südlichen Tian-Schan nebst Beschreibung einer obercarbonischen Brachiopodenfauna aus dem Kukurtuk-Tal. Von Hans Keidel. (Separat. Abdruck aus dem Neuen Jahrbuch für Mineralogie, Geologie und Paläontologie; Beilage., Band xxii.) Stuttgart, 1906. Size 9 × 6, pp. [120]. *Map and Plates. Presented by Dr. G. Merzbacher.*

Central Asia—Tian-Shan. *Abrégé B.S. Hongroise G.* **34** (1906): 175-186. **Prinz.**

Reiseskizzen aus Centralasien. Von Dr. Julius Prinz. (*Földrajzi Közlemények* **34** (1906): 440-444.)

Chinese Empire. *Petermanns M.* **53** (1907): 16-20. **Tafel.**

Briefliche Mitteilungen von Dr. Alb. Tafel über seine Reise in Zentralasien vom Juli 1906.

These letters supply further details of the traveller's journeys in the region of the upper Hwang-ho and the march thence towards Tsaidam. (See February number, p. 224.)

Chinese Empire—Historical. **Ricci.**

Dott. Ettore Ricci. Par un centenario; 25 Gennaio, 1601-1901. L'Italia nella conoscenza geografica della Cina sopratutto al principio del seicento. Macerata, 1901-4. Size 9½ × 6½, pp. 262. *Portrait. Price 5s. 6d.*

Chiefly devoted to the life and work of Padre Matteo Ricci, the Jesuit missionary.

Eastern Asia. **Plate.**

A cruise through Eastern seas; being a travellers' guide to the principal objects of interest in the Far East. By A. G. Plate. (For the Norddeutscher Lloyd,

Bremen.) London: E. Stanford, 1906. Size $8\frac{1}{4} \times 5\frac{1}{4}$, pp. 294. *Maps and Illustrations. Price 6s. Presented by the Publisher.*

East Indies—Historical. **Heeres.**
Bijdr., Taal-, Land-, en Volkenk., Ned.-Indie, VII. Ser. **3** (1907): pp. xxxii. and 586.

Corpus diplomaticum Neerlando-Indicum. Verzameling van Politieke Contracten en verdere Verdragen door de Nederlanders in het Oosten gesloten, van Privilegebrieven, aan hen verleend, enz, uitgegeven en toegelicht door J. E. Heeres. Erste Deel (1596–1650).

A reprint of treaties made by the successive Dutch East India companies with native rulers, arranged chronologically.

India. **Malcolm.**
Indian pictures and problems. By Ian Malcolm. London: E. Grant Richards, 1907. Size $9 \times 5\frac{1}{2}$, pp. xiv. and 294. *Illustrations. Price 10s. 6d. net. Presented by the Publisher.*

India—Burma. *Records Geol. Surv. India* **34** (1906): 137–147. **Oldham.**
On explosion craters in the lower Chindwin district, Burma. By R. D. Oldham. *With Illustrations.*

India—Delhi. **Hearn.**
The seven cities of Delhi. By Gordon Risley Hearn. London: W. Thacker & Co., 1906. Size $7\frac{1}{2} \times 5$, pp. xiv. and 320. *Plans and Illustrations. Price 10s. 6d. net. Presented by the Publishers.*

India—Ethnology. *J.S. Arts* **55** (1907): 324–341. **Barnes.**
The Bhils of Western India. By Captain E. Barnes.

India—Ganges. *J.R. Asiatic S.* (1907): 41–48. **Hoey.**
The five rivers of the Buddhists. By W. Hoey. *With Map.*

The five rivers are the Jumna, Ganges, Gogra, Rapti, and Gandak.

India—Himalayas. **Oakley.**
Holy Himalaya: the religion, traditions, and scenery of a Himalayan province (Kumaon and Garhwál). By E. Sherman Oakley. Edinburgh, etc.: Oliphant, Anderson, and Ferrier, 1905. Size $8 \times 5\frac{1}{2}$, pp. 320. *Illustrations. Price 7s. 6d. net.*

India—Kashmir. *B. American G.S.* **38** (1906): 657–682. **Huntington.**
The vale of Kashmir. By Ellsworth Huntington. *With Map and Sections.*

India—Population. *Ann. de G.* **15** (1906): 353–375, 419–442. **De la Blache.**
Le peuple de l'Inde d'après la série des recensements. Par P. Vidal de la Blache. *With Maps and Diagrams.*

Japan. **Honda and Terada.**
Publs. Earthquake Investigation Com., Japan **22** B. (1906): 49–74.

On the geyser in Atami. By K. Honda and T. Terada. *With Diagrams and Illustrations.*

Malay Archipelago—Borneo. **Stolk.**
Ts. K. Nederlandsch Aardrijksk. Genoots. **24** (1907): 1–27.

Opsporing van den zwervenden stam der Penjaboeng Poenan's, op de waterscheiding der Barito met de Mahakam en Kapoeas (Midden-Borneo) en October, 1905. Door J. J. Stolk. *With Map.*

On a journey undertaken for the study of one of the wandering tribes of Central Borneo.

Malay States—Survey. **Young.**
Federated Malay States. Report on the Trigonometrical and General Survey Department for the year 1905. [By A. E. Young. 1906.] Size $13\frac{1}{2} \times 8\frac{1}{2}$, pp. 6. *Presented by the Author.*

Philippines. *La G., B.S.G. Paris* **14** (1906): 343–368. **Deniker.**
Les Philippines sous la domination des Etats-Unis. Par J. Deniker. *With Map.*

Philippines—Historical. **Blair and others.**
The Philippine Islands, 1493–1898. Edited and annotated by E. H. Blair and J. A. Robertson, with . . . introduction and . . . notes by E. G. Bourne. Vols. **36–45**, 1649–1736. Cleveland, Ohio: A. H. Clark Co., 1906. Size $9\frac{1}{2} \times 6\frac{1}{2}$. *Facsimile Maps and Illustrations. Price \$4 net per volume.*

Russia—Caspian. *Iz. Imp. Russian G.S.* 41 (1905): 433-457. **Knipovich.**
Sketch of the work done by the Caspian expedition in 1904. By N. Knipovich. [In Russian.]

Russia—Caucasus. *Iz. Imp. Russian G.S.* 41 (1905): 459-505. **Bush.**
Amongst the hills of the Andisk District of Daghestan. By A. N. Bush. *With Illustrations.* [In Russian.]

Russia—Caucasus. *Iz. Imp. Russian G.S.* 41 (1905): 623-682, 683-696. **Markovich.**
In search of Eternal Ice. By V. V. Markovich. *With Illustrations.*
Short report of a journey along the Black Sea shore in the Caucasus, and on the glaciers of Abkhasia (upper course of the river Kodar), with the view to studying the flora and glaciers, made in 1903. By the same. *With Illustrations.* [In Russian.]

Russia—Siberia. *Iz. Imp. Russian G.S.* 41 (1905): 195-233. **Edelstein.**
The Northern and Central Sikhota-Alin. By Y. Edelstein. *With Illustrations.* [In Russian.]
See note in *Journal*, vol. **27**, p. 628.

Russia—Siberia—Lake Baikal. *Naturw. Wochenschrift.* 21 (1906): 721-725. **Arldt.**
Der Baikalsee, ein tiergeographisches Rätsel. Von Dr. Th. Arldt. *With Maps.*

Russia—Siberia and Turkestan. **Saposhnikoff.**
Iz. Imp. Russian G.S. 41 (1905): 697-701.
From Saur to the Dzungarian Alatau. By V. V. Saposhnikoff. [In Russian.]

Russian Central Asia—Bokhara. *Iz. Imp. Russian G.S.* 42 (1906): 39-90. **Edelstein.**
Notes on the Glaciers of the Peter the Great range. By Y. Edelstein. *With Maps and Illustrations.* [In Russian.]

Russian Central Asia—Tian Shan. *Iz. Imp. Russian G.S.* 42 (1906): 91-236. **Lipsky.**
In the mountain regions of Russian Turkestan (Tian-shan). By V. I. Lipsky. *With Maps and Plates.* [In Russian.]

Russian Central Asia. *Iz. Imp. Russian G.S.* 42 (1906): 1-37. **Shkapsky.**
Two trips into the mountains of the Tashkent district. By O. A. Shkapsky. [In Russian.]

Siberia and Mongolia. *Iz. Imp. Russian G.S.* 41 (1905): 23-154. **Komaroff.**
Journey to the Tunkinsk region and Lake Kossogol, 1902. By V. L. Komaroff. *With Map and Illustrations.* [In Russian.]

Turkey—Arabia. **Brünnow and Domaszewski.**
Die Provincia Arabia. Auf Grund zweier in den Jahren 1897 und 1898 unternommenen Reisen und der Berichte früherer Reisender beschrieben von Rudolf Ernst Brünnow und Alfred v. Domaszewski. Erster Band: Die Römerstrasse von Mâdebâ über Petra und Odruh bis El-'Akaba. Zweiter Band: Die äussere Limes und die Römerstrassen von El-Ma'an bis Bosra. Strassburg: Karl J. Trübner, 1904-1905. Size 13 × 10, pp. (vol. 1) xxiv. and 532; (vol. 2), xii. and 358. *Maps, Plans, and Illustrations. Price* (vol. 1) *M.* 80; (vol. 2), *M.* 60.
Mainly concerned with antiquities, but indispensable for any thorough study of the historical geography of the region.

Turkey—Arabia—Yemen. *Riv. Coloniale* 2 (1906): 66-86. **Rossi.**
Nell' Jamen; impressioni di viaggio, note e ricordi. D. G. B. Rossi. *With Map and Illustrations.*

Turkey—Mesopotamia. **Willcocks.**
The Irrigation of Mesopotamia. By Sir William Willcocks. Cairo, 1905. Size 10½ × 7, pp. 154. *Maps. Presented by the Author.*

Turkey—Syria and Palestine. **Hanauer and Masterman.**
Cook's Handbook for Palestine and Syria. New edition, thoroughly revised by the Rev. J. E. Hanauer and Dr. E. G. Masterman. London: Cook & Sons, 1907. Size 7 × 4½, pp. viii. and 416. *Maps. Price 7s. 6d. net. Presented by the Publishers.*

AFRICA.

British Central Africa—Ethnology. **Werner.**
The Native of British Central Africa. By A. Werner. (The Native Races of the

British Empire.) London: A. Constable & Co., 1906. Size 9 × 5½, pp. xii. and 304. *Sketch-map and Illustrations. Price 6s. net. Presented by the Publishers.*

The first volume of this useful series was noticed in the April number.

Morocco. *La G., B.S.G. Paris* **14** (1906): 369-374. **Gentil.**

L'œuvre topographique du capitaine Larras au Maroc. Par Louis Gentil. *With Sketch-map.*

Nigeria. **[Egerton.]**

Southern Nigeria. Report for 1905. (Colonial Reports, Annual, No. 512, 1906.) Size 9½ × 6, pp. 64. *Price 8d.*

Réunion. *K.A.W. Amsterdam, G. Sect. Sc.* **8** (1905): 110-126. **Oudemans.**

Supplement to the account of the determination of the longitude of St. Denis (Island of Réunion), executed in 1874, containing also a general account of the transit of Venus. By Prof. J. A. C. Oudemans.

Rhodesia—Botany. *J. Linnean S., Botany* **37** (1906): 425-494. **Gibbs.**

A Contribution to the Botany of Southern Rhodesia. By Miss L. S. Gibbs. *With Illustrations.*

The illustrations explain the general characters, rather than the purely botanical features, of the vegetation.

Rhodesia—Language. **Schoeffer.**

A grammar of the Bemba language, as spoken in North-East Rhodesia. By Rev. Father Schoeffer. Edited by J. H. West Sheane; arranged by A. C. Madan. Oxford: Clarendon Press, 1907. Size 7 × 4½, pp. 72. *Price 2s. 6d. net. Presented by the Publishers.*

Sahara. *La G., B.S.G. Paris* **14** (1906): 317-341. **Cortier.**

De Tombuctou à Taodéni. Relation du raid accompli par la compagnie des méharistes du 2ᵉ Sénégalais commandée par le Capitaine Cauvin, 26 février—17 juin 1906. Par le Lieut. Cortier. *With Map and Plans.*

See note in the March number.

St. Helena. *J.R. Col. I.* **38** (1906): 38-49. **Melliss.**

St. Helena. By J. C. Melliss.

St. Helena. **Morris.**

Colonial Reports, Miscellaneous, No. 38. Reprint of a Report (written in 1884) upon the Present Position and Prospects of the Agricultural Resources of the Island of St. Helena. By D. Morris. London, 1906. Size 9½ × 6, pp. 36. *Map. Price 3½d.*

South Africa. *G.Z.* **12** (1906): 601-611. **Penck.**

Süd-Afrika und Sambesifälle. Von Albrecht Penck.

Some of Prof. Penck's conclusions, arrived at during his journey in South Africa with the British Association, were referred to in vol. **27**, p. 630.

Sudan. **Kumm.**

The Sudan. A short compendium of facts and figures about the land of darkness. By H. Karl W. Kumm. London: Marshall Bros., [1907]. Size 9 × 5½, pp. xiv. and 224. *Maps and Illustrations. Price 6s. 3d. net. Presented by the Publishers.*

A concise account of the Sudan by a missionary who has made a special study of its literature, and possesses personal knowledge both of its eastern and western sections.

Transvaal—Geology. ———

Transvaal Mines Department. Report of the Geological Survey for the year 1905. Pretoria, 1905. Size 13 × 8½, pp. 114. *Maps, Illustrations, and Sections.*

Tunis. *Norske G.S. Aarbog.* **17** (1905-6): 65-96. **Reusch.**

Tunis. Af Dr. H. Reusch. *With Illustrations.*

Uganda—Botany. *J. Linnean S., Botany* **37** (1906): 495-544. **Stapf and Dawe.**

Plantæ Novæ Daweanæ in Uganda lectæ. By Otto Stapf. Notes on the Vegetation of Buddu and the Western and Nile Provinces of the Uganda Protectorate. By M. T. Dawe. *With Map and Illustrations.*

The general results of Mr. Dawe's journey were described in the *Journal* for September, 1906 (p. 291).

West Africa—Boundary. ———

Treaty Series, No. 5, 1907. Agreement between the United Kingdom and France relative to the frontier between the British and French possessions from the Gulf of Guinea to the Niger. October 19, 1906. London, 1907. Size $9\frac{1}{2} \times 6$, pp. 14. *Maps.* *Price* 1*s.* 1*d.*

The line of frontier is described in detail.

POLAR REGIONS.

Antarctic. *La G., B.S.G. Paris* **14** (1906): 245–260. **Charcot.**

Exposé des travaux scientifiques de l'expédition antarctique française, 1903–1905. Par Jean Charcot. *With maps and Illustrations.*

Antarctic—Fauna. *T.R.S. Edinburgh* **41** (1904–05): 519–532. **Eliot.**

The Nudibranchiata of the Scottish National Antarctic Expedition. By Sir Charles Eliot. *With Illustrations.*

Antarctic—Fauna. **Rennie and others.**
P.R.S. Edinburgh **26** (1905–6): 437–446, 464–583.

"Scotia" collections. On *Echinorhynchus antarcticus*, n. sp., and its allies. By John Rennie. *With Plates* (pp. 437–446).
Nematodes of the Scottish National Antarctic Expedition, 1902–1904. By Dr. v. Linstow. *With Plates* (pp. 464–472).
Collembola from the South Orkney Islands. By George H. Carpenter. *With Plates* (pp. 473–483).

Arctic—Historical. **Hoare.**

Arctic Exploration. By J. Douglas Hoare. London: Methuen & Co., [1906]. Size $9 \times 5\frac{1}{2}$, pp. viii. and 314. *Maps and Illustrations.* *Price* 7*s.* 6*d. net.*

Deals mainly with the work of the nineteenth century, the early voyages being very briefly touched upon. A certain lack of proportion is sometimes noticeable. Thus hardly more than a page is devoted to the voyage of the *Vega*, while Franklin's land journeys, only in part concerned with the Arctic regions, are dealt with at length.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Limestone Reefs. *Quarterly J. Geol. S.* **62** (1906): 702–711. **Chapman and Mawson.**

On the importance of *Halimeda* as a Reef-forming Organism, with a description of the *Halimeda* Limestones of the New Hebrides. By Frederick Chapman and Douglas Mawson. *With Illustrations.*

Limnology—Temperatures. *Naturw. Wochenschrift.* **21** (1906): 705–709. **Risch.**

Die thermische Sprungsicht der Seen. Von C. Risch. *With Diagrams.*

Meteorology. ———

Kaiserliche Marine: Deutsche Seewarte. Tabellarische Reiseberichte nach den meteorologischen Schiffstagebüchern. 3. Band. Eingänge des Jahres 1905. Berlin, 1906. Size $10\frac{1}{2} \times 7\frac{1}{2}$, pp. viii. and 192.

Meteorology—Atmosphere. **Legendre.**
B. Musée Oceanographie, Monaco, No. 84 (1906): pp. 8.

Le teneur en acide carbonique de l'air marin. Par R. Legendre. *With Illustration and Map.*

Meteorology—Aurora. **Arrhenius.**

Die Nordlichter in Island und Grönland. Von Svante Arrhenius. (Meddelanden från K. Vetenskapsakademiens Nobelinstitut, Band I., No. 6.) Upsala, etc., 1906. Size 9×6, pp. 28. *Illustrations and Diagram.* *Price* 75 *öre.*

Meteorology—Precipitation. **Marloth and Hann.**
Meteorologische Z. **23** (1906): 547–553.

Ueber die Wassermengen, welche Sträucher und Bäume aus treibendem Nebel und Wolken auffangen. Nach Dr. Marloth.

Besides describing the results of Dr. Marloth's experiments (*Journal*, vol. **24**, p. 96; vol. **28**, p. 76), Dr. Hann refers to earlier investigations on the same subject.

Meteorology—Temperature. *Monthly Weather Rev.* **34** (1906): 370–374. **Milham.**
Variation in temperature over a limited area. By Prof. Willis I. Milham. *With Diagrams.*

Mountain-building. *C.R.A. Sc., Paris* **143** (1906): 1268–1269. **Meunier.**
Sur d'anciennes expériences de M. Daubrée et de M. de Chancourtois relatives à l'imitation des chaînes de montagnes. Note de Stanislas Meunier.

Oceanography—Relief. **Ricchieri**
Terminologia Morfografica dei Fondi Oceanici. Considerazioni e proposte del Prof. Giuseppe Ricchieri. (Estratto dalla 'Rivista Geografica Italiana,' Anno xiii. Fascicolo viii. e ix.) Firenze, 1906. Size 9½ × 6, pp. 20. *Presented by the Author.*

Seismology. **Schütt.**
Die Hauptstation für Erdbebenforschung am Physikalischen Staatslaboratorium zu Hamburg. Von Dr. R. Schütt. (Sonderabdruck aus 'Die Erdbebenwarte,' 1905–06, Nr. 9 bis 12, V. Jahrgang.) Laibach, 1906. Size 9½ × 6½, pp. 6. *Illustrations. Presented by the Author.*

Seismology. *Sc. P.R. Dublin S.* **11** (1906): 107-110. **Gill.**
On a possible connection between the Eruption of Vesuvius and the Earthquake at San Francisco in April, 1906. By the Rev. H. V. Gill.

Noticed in the March number.

Seismology. *G. Ts., K. Danske G.S.* **18** (1905–06): 288-295. **Harboe.**
En sejsmologisk Oversigt. Af Oberstløjtnant E. G. Harboe. *With Map.*

Volcanoes. *J. Bombay Br., R. Asiatic S.* **22** (1906): 135-142. **Modi.**
Maçoodi on Vulcanoes. By Jivanji Jamshedji Modi.

Volcanoes. *Mem. American A.* **13** (1906): 149-178. **Pickering.**
Lunar and Hawaiian physical features compared. By William H. Pickering. *With Illustrations and Sections.*

BIOGRAPHY.

Bonpland. **Hamy.**
Aime Bonpland; médecin et naturaliste; explorateur de l'Amérique du Sud. Par le Dr. E. T. Hamy. Paris: E. Guilmoto, [1906]. Size 9 × 5½, pp. xcviii. and 300. *Map and Portrait. Price* 7.50 *fr.*

An introductory section presents a biography of the traveller, based on original documents, a selection from which is printed in the body of the work.

Burchell. **Poulton.**
William John Burchell. By Edward B. Poulton. (Reprinted from the *Report of the British and South African Associations,* 1905.) London, 1907. Size 9 × 6, pp. 56. *Portrait. Presented by the Author.*

Sheds fresh light on Burchell's travels in South Africa and Brazil early in the nineteenth century.

GENERAL.

Educational. *B.G.S. Philadelphia* **5** (1907): 30-36. **Dryer.**
The Oxford School of Geography. By Charles Redway Dryer.

Geography—Dictionary. **Demangeon.**
Dictionnaire-manuel illustré de géographie. Nomenclature des noms de lieux, des voyageurs, explorateurs et géographes; définitions de physique terrestre, de météorologie, de morphologie, de géographie botanique, zoologique et humaine, de géographie industrielle, commerciale, maritime et politique; définitions de cartographie. Par Albert Demangeon. Paris: A. Colin, 1907. Size 7½ × 4½, pp. viii. and 860. *Maps, Illustrations, and Diagrams. Price* 6 *fr. Presented by the Publisher.*

A most useful work, the want of which must have been frequently felt by students, though the labour involved in its compilation has no doubt deterred many from undertaking it.

German Colonies—Bibliography. **Reimer.**

Dietrich Reimer's Mitteilungen über koloniale Bücher u. Karten. Ratgeber für deutsche Ansiedler, Pflanzer, Kolonialbeamte, Offiziere der Schutztruppen, Forschungsreisende, Bibliotheken und Kolonialfreunde. Heft 1. Januar 1907. Berlin: D. Reimer, 1907. Size 8½ × 6, pp. 82. *Index-maps and Diagrams. Price 30 pf. Presented by the Publisher.*

Irrigation. *Z. Ges. E., Berlin* (1906): 540-648, 674-685. **Hahn.**

Ueber künstliche Bewässerung, besonders den Ackerbau mit künstliche Bewässerung nach der Theorie Ferdinand von Richthofens. Von Dr. Eduard Hahn.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

British Isles. **Woodward.**

Stanford's Geological Atlas of Great Britain and Ireland, with plates of characteristic fossils, preceded by descriptions of the geological structure of Great Britain and Ireland and their counties, and of the features observable along the principal lines of railway. By Horace B. Woodward, F.R.S., F.G.S. Second edition. London: Edward Stanford, 1907. *Price* 12*s.* 6*d. net. Presented by the Publisher.*

In the second edition of this interesting and instructive little atlas, the scope of the work has been enlarged by the addition of a sketch of the geological features of Ireland, which is illustrated by a geological map of the country and three illustrations borrowed from Prof. E. Hull's 'Physical Geology and Geography of Ireland.' The text as given in the first edition has been but slightly altered, but the maps have been revised.

England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from May 1 to 31, 1907.

2 miles to 1 inch.

Printed in colours, folded in cover or flat in sheets, Birmingham and District, special map of. *Price, on paper,* 1*s.* 6*d.*; *mounted on linen,* 2*s.*; *mounted in sections,* 2*s.* 6*d. each.*

1 inch—(third edition):—

In outline, sheets (81 and 82), 89, 91, 170, 206, 248, 295, 312 1*s. each* (engraved). With hills in brown or black, 72, 171, 172, 186, 246, (261, and 262), 296 (357 and 360). 1*s. each* (engraved).

6-inch—County Maps (first revision):—

Carmarthenshire, 9 N.W., 13 S.E., 14 S.E., 16 N.W., N.E., S.W., S.E., 17 N.W., S.W., S.E., 18 N.W., N.E., 22 N.E., S.W., S.E., 23 N.W., 25 N.W., 49 S.W., 55 N.E. **Cornwall,** 1 (S.W. and S.E.), 4 N.W., 6 N.W., S.W., 8 N.E., 16 N.E., 23 N.W., 29 N.W., 30 N.W. **Devonshire,** 42 S.W., 49 S.E., 61 N.W., 73 N.W., S.E., 74 N.W., S.W., 85 N.E., 86 N.W., 96 N.E., 98 S.W., 121 S.W., 125 S.W. **Lincolnshire,** 34 N.W., S.E., 38 N.W., N.E., S.W., 39 N.W., 47 N.W., 48 N.E., 49 N.W., (49 S.E., and 49*a* S.W.), 58 S.W. **Norfolk,** 39 S.E., 40 N.W., S.E., 52 S.E., 87 S.E. **Pembrokeshire,** 12 N.E. **Yorkshire** (First Revision of 1891 Survey), 263 N.W., 273 N.E., 274 N.W., 278 N.W. 1*s. each.*

25-inch—County Maps (first revision):—

Carmarthenshire, XXVIII. 7, 8, 14, 15; XXXVI. 3, 6, 7; LIX. 2. 3*s. each.* XXVIII. 6. 1*s.* 6*d.* **Cornwall,** XVIII. 16; XX. 2, 11, 15; XXV. 7, 10; XXXII. 13, 14, 15, 16; XXXIII. 13, 14, 15, 16; XXXIV. 1, 6, 13, 14, 15, 16; XXXIX. 3, 6, 9, 12, 14, 15, 16; XL. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15; XLI. 1, 2, 3, 4; XLII. 1, 2, 3, 6, 8, 10; XLIII. 1, 5, 9, 13; XLVIII. 2, 3, 4, 6, 7, 8; XLIX. 1, 2, 3, 5, 6, 7, 9, 11; LI. 2, 3, 6, 8, 11, 12, (15 and 16); LII. 1, 5, 9. **Lancashire (First Revision of 1891 Survey),** CIX. 4, 8, 12, 16; CX. 9; CXI. 5, 6, 7, 8, 10, 12; CXII. 5; CXIII. 11, 12, 16; CXIV. 9, 11, 13, 16; CXV. 6, 7, 9, 10, 13, (14 without areas); CXVI. 4; CXVIII. 2, 3, 4, 7. 3*s. each.* CX. 7, 8; CXI. 14; CXII. 6, 9. 1*s.* 6*d. each.* **Lincolnshire** (First Revision), XVIII. 10, 16; XXX. 4; XXXI. 16; XXXII. 13; LXI. 14, 15; LXX. 1, 2, 3, 4, 5, 6, 8, 10, 11, 12, 13, 15, 16. **Pembrokeshire,** VI. 15, 16; XI. 4, 5, 6, 7, 9, 13, 14; XVIII.

5, 6, 7. **Yorkshire** (First Revision of 1891 Survey), CCXXII. 9, 13; CCXXXVII. 13; CCXLVI. 12, 15; CCXLVII. 1, 8, 12, 13, 15, 16; CCXLIX. 1, 2. **Kent** (Second Revision), XXIV. 8, 12; XXV. (2 and 6), 4, 5, (6 and 2), 7, 9, 10, 11, 12, 14, 15, 16; XXVI. 1, (2 and 6), 5, (6 and 2), 9, 10, 13, 14; XXXV. 6, 7, 8, 12; XXXVI. 5, 9; XXXVII. 2, 3, 6, 7, 10, 11; XXXVIII. 1, 5; XLVI. 14, 15, 16; XLVII. 13; LVI. 4; LVII. 1; * LXXIV. 4; LXXV. 1, 3; * LXVII. 6, 7, 10. 11, 13, 14, 15; LXXIV. 3, 4, 6, 7, 8, 10, 11, 12, 14, 15, 16; LXXXVI. 1, 2, 4, 5, 7. 3*s. each.*

(*E. Stanford, London Agent.*)

France. **Ministre de l'Intérieur, Paris.**

Carte de la France dressée par ordre du Ministre de l'Intérieur. Scale 1 : 100,000 or 1 inch to 1·3 stat. mile. Sheets: xvii.-28, St. Cernin (Cantal); xxiii.-29, Die: xxv.-25, Sallanches; xxv.-31, Barcelonnette. New editions. Paris: Ministère de l'Interieur, Service Vicinal, 1907. *Price* 0.80 *fr. each sheet.*

Holland. **De Geest.**

Kaart van Nederland met de Spoor-, Tram-, Straat, en Kunstwegen. Door E. de Geest. Met Alfabetisch Register der Plaatsnamen. Scale 1 : 400,000 or 1 inch to 6·3 stat. miles. Amsterdam: Seyffardt's Boekhandel, 1907. *Price f.* 1.25.

A useful general map, showing means of communication by rail and water, and including the Netherlands, Belgium north of Brussels, and part of western Prussia. There is an alphabetical index to place-names accompanying the map.

London. **Bartholomew**

Plan of London. By John Bartholomew, F.R.G.S. Scale 3·25 inches to 1 stat. mile. 4 Sections. Edinburgh: John Bartholomew & Co. [1907]. *Price* 2*s.* [illegible] *mounted on cloth. Presented by the Publisher.*

A revised edition of a clear and useful plan of London and environs, printed in colours. Sheets are in outline, only the important buildings being shaded.

Switzerland **Abteilung für Landestopographie, Bern**

Topographischer Atlas der Schweiz (Siegfried Atlas). Scale 1 : 25,000 or 2·5 inches to 1 stat. mile. Sheets: 7, Therwil; 13, Schleitheim; 114, [illegible]; 115, Les Bois; 135, Twann; 230, Wald; 231, Wattwil; 232, Schmerikon; [illegible], Schaibeltuch; 247, Schanis; 25[illegible], Speer, 1906; 255, Buchs; 283, Ste. Croix; [illegible], Ligerzelle; 292, Orbe; 331, Fribourg; [illegible], Wattenwil; 355, Thun. New editions. Bern: Abteilung für Landestopographie, 1906. *Price* 1 *fr. each sheet.*

ASIA

Asia **Service Géographique de l'Armée, Paris**

Carte de l'Asie. Scale 1 : [illegible] or 1 inch to 15·[illegible] stat. miles. Sheets: [illegible] Tachkent. Paris: Service Géographique de l'Armée, 1906. *Price* [illegible] *each sheet.*

[illegible] region between [illegible] N. lat., and extend [illegible] east to west [illegible] from the Oxus to about 30 miles [illegible] of Andijan, the terminus of the Trans-Caspian railway.

China **K. Preussische Landesaufnahme**

Karte von Ost-China [illegible] Scale 1 : [illegible] or 1 inch to 15·[illegible] stat. miles. Sheets: [illegible] Berlin: K. Preussische Landesaufnahme, 1907.

Persia. **Stahl.**

[illegible] Aufnahmen von A. F. Stahl. Scale 1 : [illegible] Petermanns Mitteilungen, Ergänzung [illegible] 1907. [illegible] *Presented by the Publisher.*

The [illegible] from the Araxes in the west, through [illegible] and [illegible] in the east, and from Resht [illegible] the Caspian [illegible] The result of the author's journeys [illegible] for the last month.

AFRICA

Alexandria **Survey Department, Cairo**

[illegible] Sheets. Cairo: Survey [illegible] *Presented by the Director-General, Survey Department, Cairo.*

Egypt. **Survey Department, Cairo.**

Map of Egypt. Scale 1 : 50,000 or 1·3 inch to a stat. mile. Sheets: N.E. I.-II., III.-III.; S.E. XIV.-II., XV.-I., XV.-II., XVI.-II., XVI.-III., XVII.-II., XVII.-III., XVII.-IV., XVIII.-III., XVIII.-IV., XIX.-III., XIX.-IV., XIX.-V., XXX.-VIII. Cairo: Survey Department, 1907. *Presented by the Director-General, Survey Department, Cairo.*

Northern Nigeria. **Marquardsen.**

Karte des Gebietes zwischen Ibi und Gola. Von H. Marquardsen. Scale 1 : 750,000 or 1 inch to 18·9 stat. miles. *Petermanns Mitteilungen*, Jahngang 1907, Tafel 9. Gotha: Justus Perthes, 1907. *Presented by the Publisher.*

A route followed in March, 1903, along the southern bank of the Benue from Ibi to Yola. No astronomical observations were taken, and the traverse is adjusted to positions previously determined. A note accompanying the map is given in the May number of *Petermanns Mitteilungen.*

Tunis. **Service Géographique de l'Armée, Paris.**

Carte de la Tunisie. Scale 1 : 100,000 or 1 inch to 1·3 stat. mile. Sheet LXIX., La Skhirra. Paris: Service Géographique de l'Armée, 1907. *Price 1.50 fr. each sheet.*

AMERICA.

Canada. **Department of Militia and Defence, Ottawa.**

Topographic map of Canada. Scale 1 : 63,360 or 1 inch to a stat. mile. Ontario. Sheets: 4, Grimsby; 7, Fort Erie. Ottawa: Intelligence Branch, Department of Militia and Defence. London: Topographical Section, General Staff, War Office, 1907. *Presented by the Director of Military Operations.*

The Grimsby sheet extends from 43° to 43° 15′ N. lat., and from 79° 30′ to 80° W. long., and includes the southern portion of Hamilton and Grimsby on Lake Ontario. The Fort Erie sheet is occupied by the city of Buffalo and its immediate surroundings. Both are carefully drawn and printed in colours, as described in the notice of the first sheets to be issued, which appeared in the April number of the *Geographical Journal.*

Canada. **White.**

Atlas of Canada. Prepared under the direction of James White, F.R.G.S., Geographer, Department of the Interior, Canada. Ottawa: Department of the Interior, 1906. *Presented by James White, Esq.*

For emigrants and others desirous of obtaining reliable and up-to-date information concerning the resources, development, and physical geography of the Dominion of Canada, this is a most important publication. It furnishes graphically, by means of an excellent series of maps, diagrams, and statistical tables, the latest information on these subjects from the most authentic sources. There are, first of all, thirteen pages of statistical tables, giving areas and population of various provinces and cities, towns, and villages, from the census returns of 1901; then follows a series of forty-six coloured maps, illustrative of the relief, geology, mineral resources, forests, telegraphs and telephones, railways, canals, lighthouses, sailing routes, temperature, density of population, and other subjects. After these come forty-three plates of diagrams, giving at a glance a very clear idea of the exports, imports, distribution of the population, vital statistics, religions, agricultural and mineral development, fisheries, and many other matters connected with the material and commercial progress of the Dominion. Earlier editions of some of the maps have previously appeared as separate publications, but the greater number of them have been specially prepared for this atlas.

Chile. **Steffen.**

Das Haupterschütterungs-Gebiet des Mittelchilenischen Erdbebens vom 16. August 1906. Von H. Steffen. Scale 1 : 500,000 or 1 inch to 7·8 stat. miles. *Petermanns Mitteilungen*, Jahgang 1907, Tafel 11. Gotha: Justus Perthes, 1907. *Presented by the Publisher.*

GENERAL.

World. **Harmsworth.**

Harmsworth Atlas and Gazetteer. 500 maps and diagrams, and 105,000 references. Parts 15 and 16. London: The Amalgamated Press, Ltd., 1905. *Price 7d. each part.*

These parts contain the following maps:—Part 15. Nos.: 19–20, The British Isles (industries and communications); 119, Southern India and Ceylon; 120, the Malay

Peninsula; 171–172, North-central United States. Part 16, Nos.: 7–8, The New World; 49–50, Eastern France; 81–82, Northern Italy.

World. **Johnston.**

The Handy Royal Atlas of Modern Geography, exhibiting the present condition of geographical discovery and research in the several countries, empires, and states of the world. By the late Alexander Keith Johnston, with additions and corrections to the present date by G. H. Johnston. Edinburgh and London: W. & A. K. Johnston, 1907. *Price* £2 12*s*. 6*d*. *Presented by the Publisher.*

The maps in this well-known and useful atlas have been, on the whole, fairly well revised as regards alterations to boundaries, new railways, etc.; but on some of the maps the physical features are seriously behind the times, as will be seen from an inspection of No. 39, Abyssinia, which is much out of date. A good and carefully executed map of the Arctic Regions is given, and an entirely new map of Japan has been added; but it is remarkable, considering the recent activity and important discoveries made in the neighbourhood of the south pole, that no map is given of this region.

World. **St. Martin and Schrader.**

Atlas Universel de Géographie construit d'après les sources originales et les documents plus récents, cartes, voyages, mémoires, travaux, géodésiques, etc., avec un texte analytique. Ouvrage commencé par M. Vivien de Saint Martin et continué par Fr. Schader. Sheet No. 63, Algérie, Tunisie. Paris: Hachette et Cie., 1907. *Presented by the Publisher.*

This map is the work of Lieut.-Colonel F. Prudent, who is a recognized authority on the cartography of Algeria and Tunis, and a good topographer. It includes the whole of Algeria and Tunis, and extends as far south as the 27th parallel of north latitude. A sheet of letterpress accompanies the map, giving a list of surveys and maps utilized in the compilation, together with other information. As a specimen of copperplate engraving, this map is excellent, but the fact that the hill-work is printed in black gives it a somewhat dull and heavy appearance, besides rendering it difficult to read the names in places. It would be a great improvement if the hill-work could be printed in brown in another edition.

World. **Stieler.**

Neunten, von Grund aus neubearbeiteten und neugestochenen Auflage von Stielers Hand-Atlas, 100 Karten auf 200 Seiten mit 162 Nebenkarten in Kupferstich und einem alphabetischen Verzeichnis aller im Atlas verkommenden Namen (ungefähr 240,000 Namen enthaltend) herausgegeben von Justus Perthes' Geographischer Anstalt in Gotha. Lieferung 53 and 54. Gotha: Justus Perthes, 1907. *Price* 60 *pf. each part.*

These parts contain the following maps: Parts 53–54, Nos. 22, Italien, Bl. 1; 75, Afrika, Bl. 7; 81, Südsee-Inseln.

Charts.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during April, 1907. *Presented by the Hydrographer, Admiralty.*

New Charts.

No.	Inches.	
3604 m	= 0·7	Baltic sea, Sweden, east coast:—Stockholm Skärgård, southern portion. 3*s*.
3640 m	= 3·55	France, west coast:—Anse de Benodet. 3*s*.
3654 m	= 3·6	North American lakes, Lake Erie:—Sandusky bay, eastern portion. 2*s*.
3627 m	= var.	South America, Magellan strait. Anchorages in Martinez and Baker channels:—Port Merino Jarpa, Laguera cove, Port Valdes, Port Alvarez. Port Cueri Cueri, Port Valenzuela, Port Brown, Dewet cove, Port Tres Meses, Port Contreras, river Huemules, Port Quellehue, Port Francisco. 3*s*.
3634 m	= var.	Alaska. Plans in Prince of Wales island:—McKenzie inlet, Hollis anchorage, Cordova bay and Hetta inlet, Dolomi anchorage and Port Johnson, North arm of Moira sound, Lyman anchorage. 3*s*.
3637 m	= var.	Alaska. Plans in the neighbourhood of Chatham strait:—Red Bluff bay, Hoggatt bay. Herring bay and Chapin bay, Gut bay, Surprise harbour and Murder cove. 3*s*.

No.	Inches.	
3658 m =	2·7	Alaska:—Whitewater and Chaik bays. 2s.
3655 m =	0·6	Plans in Alaska:—Resurrection bay. 2s.
593 m =	0·06	Alaska, Yukon river to point Barrow, including Bering strait. Plans:—Anchorage of Chamisso, Port Clarence and Grantley harbour. 3s.
3648 m =	{0·48, 2·96}	Africa, west coast:—Junk river to Cestos bay. Plan:—Grand Bassa. 3s.
1257 m =	0·31	Korea:—Approaches to Ping Yang inlet and Yalu kiang, Choppeki point to Amunyoku kang (Yalu kiang). 3s.
3642 m =	0·97	Korea:—A San anchorage and approaches. 2s.
3631 m =	5·9	Japan, Kiusiu, west coast:—Yanagino seto and approaches. 2s.
3639 m =	var.	Japan. Plans in the north part of Honshu (Nipon):—Funakoshi wan, same anchorage, Fuku ura, Nezugaseki ko, Kuji wan. 2s.
3641 m =	0·99	Australia, south coast:—Nepean bay. 2s.

New Plans and Plans added.

No.	Inches.	
472 m =	2·9	Harbours and anchorages on the coast of Haïti or San Domingo. Plan added:—Port Jackson. 3s.
2406 m =	1·3	Ports in San Domingo. Plan added:—Port Rincon. 2s.
2194 m =	{2·9, 0·72, 7·30}	Sketch plan of anchorages in the eastern part of the Celebes. New plans:—Parigi road, Muton road. Plan added:—Labua sore. 2s.
2718 m =	2·9	Anchorages on the east coast of the Celebes. New plans:—Una Una road, Togian bay, Pagimana road. 2s.

Charts Cancelled.

No.	Cancelled by	No.
593 Alaska:—Point Rodney to Point Barrow. Plans:—Chamisso anchorage, Port Clarence and Grantley harbour.	New chart. Yukon river to Point Barrow, including Bering strait. Plans:—Anchorage of Chamisso, Port Clarence, and Grantley harbour	593
1364 Africa, west coast:—Cape Mesurado to Baffu bay. Plan of Edina and Grand Bassa on this sheet.	Plan of Grand Bassa on chart	3648
1257 Korea. Approaches to Ping Yang inlet:—Peng Yong do to Yalu kiang.	New chart. Approaches to Ping Yang inlet, Choppeki point to Amunyoku kang (Yalu kiang)	1257

Charts that have received Important Corrections.

No. 109, England, east coast:—Entrance to the river Humber. 2184, Ireland, south-west coast, including Crookhaven. 1804, France:—Cape St. Sebastian to Cette. 2755, United States, east coast:—Long island sound, Sheet II. 761, West Indies, India islands, and Caribbean sea, Sheet I. 762, West Indies, India islands, and Caribbean sea, Sheet II. 2088, Africa, south coast:—Umtavuna river to Tugela river. 2137, Gaspar strait. 2636, Strait of Makassar, north part. 1261, Cochin China:—Saigon river to Kam ranh bay. 1459, China, south coast:—Hong Kong harbour. 2409, West coast of Formosa and Pescadores channel. 809, Tasmania:—Frederick Henry and Norfolk bays. 2766, North-east coast of New Guinea. 764, South-West Pacific:—New Hanover, New Ireland, and New Britain. 2532, New Zealand, Sheet IX.:—Banks peninsula to Otago.

(*J. D. Potter, Agent.*)

Indian Ocean and Red Sea. **Meteorological Office.**

Monthly meteorological chart of the Indian Ocean north of 15° S. lat. and Red sea, June, 1907. London: Meteorological Office, 1907. *Price 6d. each. Presented by the Meteorological Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Monthly meteorological chart of the North Atlantic and Mediterranean, June, 1907. London: Meteorological Office, 1907. *Price 6d. each. Presented by the Meteorological Office.*

North Atlantic. **U.S. Hydrographic Office.**

Pilot chart of the North Atlantic Ocean, May, 1907. Washington: U.S. Hydrographic Office, 1907. *Presented by the U.S. Hydrographic Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot chart of the North Pacific Ocean, June, 1907. Washington: U.S. Hydrographic Office, 1907. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Dutch Guiana. **Klein.**

Forty photographs of Dutch Guiana, taken by Eugen Klein, Photographer, Paramaribo. *Presented by C. W. A. Buma, Esq.*

From an ethnographical point of view, these photographs are of special interest, as the types of natives are remarkably good and well selected. Mr. Buma travelled some distance into the interior of Dutch Guiana last year, and on his return recently was good enough to add this set to our collection.

(1–6) Carib Indians, Boven Para; (7) Carib Indians hunting, Coropina creek, Boven Para; (8) Carib Indian woman making mats; (9) Carib Indian camp, Boven Para; (10) Carib Indian women grinding cassava meal; (11) Carib Indian women pounding cassava meal, Cottica; (12) Carib Indians, Galibi village, near Ablina; (13) Indian village, Boven Para; (14 and 15) Arawak Indians, Boven Para; (16) Europeans at a bush negro camp, Cottica; (17) Bush negroes in their corial, Boven Cottica; (18) Bush negroes, Wanhati, Cottica; (19) Bush negroes in the Saramacca; (20) Bush negroes with their corials at Cabende station, Boven Saramacca; (21) Bush negro chief with his retinue; (22) Indian village in the Cottica; (23) Showing children of the different races who attend the convent school, Paramaribo; (24) Bush negro governor.

New Zealand. **Ross.**

Thirty-one photographs of the New Zealand Alps, taken by Malcolm Ross, Esq. *Presented by G. E. Tolhurst, Esq.*

These photographs vary in size and excellence, but some are exceptionally good, and together they form an interesting and typical series illustrative of the peaks, glaciers, and mountaineering in the New Zealand Alps.

(1) Mount Ruapehu from the eastern side; (2) Looking at north peak of Ruapehu; (3) The old crater and glacier on the summit of Mount Ruapehu; (4) Mount Cook; (5) Looking back at Mount Sefton from the slopes of Mount Sealy; (6) Crossing the Hooker river in a "cage;" (7) The Hermitage, Mount Cook accommodation house; (8) Deep crevasse on the upper Tasman; (9) Ice-cliffs on the lower Tasman; (10) The Ball glacier, showing the formation of lateral moraine; (11) The Hooker river and glaciers of the Footstool, Mount Sefton; (12) The bivouac for the ascent of Mount Cook; (13) Mount Tasman, from 10,000 feet on Mount Cook; (14) Peaks of Liebig range; (15) Mount Cook range from the slopes of Mount Malte Brun range; (16) Mount Elie de Beaumont; (17) Alpine flora, Mount Cook region; (18) View looking south-west from the summit of Mount Sealy; (19) The upper precipices of Mount Sealy; (20) Fitzgerald's cairn on summit of Mount Sealy; (21) Mount Malte Brun; (22) Panorama of main range from Ball glacier; (23) Panorama showing some peaks on Malte Brun range; (24) The Mount Cook bivouac; (25) Arrival at the Mount Cook bivouac, on the first crossing of the mountain, 1906; (26) Actual summit of Mount Cook; (27) Broken ice on upper Tasman glacier; (28) Mount Sefton from Mount Sealy slopes; (29) Mount Cook from Sealy range; (30) On the Sealy range above the Hermitage; (31) Looking back at Mount Cook from the Tasman near Mount Malte Brun.

Siam. **Jardine.**

Three photographs of a Siamese native woman suckling a baby elephant, taken by Jardine, photographer, Cawnpore. *Presented by Lieut.-Colonel A. Gleadowe Newcomen.*

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

The
Geographical Journal.

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THE FRANKLIN SEARCH: FIFTIETH ANNIVERSARY OF THE SAILING OF THE "FOX."

On the occasion of the fiftieth anniversary of the sailing of the Franklin Search Expedition in the *Fox*, fitted out by Lady Franklin, the following letter was addressed to Admiral Sir Leopold M'Clintock, K.C.B., the commander of the expedition, by Sir George Taubman Goldie, President of the Society, Sir Clements R. Markham, Vice-President, and himself a member of a previous search expedition, and Sir Allen Young, navigation officer of the *Fox*:—

"1, Savile Row, Burlington Gardens, June 30, 1907.

"Dear Sir Leopold M'Clintock,

"In the name and on behalf of the Council of the Royal Geographical Society, we salute and congratulate our Gold Medalist of 1860, and one of the most valued of our colleagues, on a great occasion. For this day is the fiftieth anniversary of the departure of the *Fox* on her memorable voyage.

"We are reminded of your long preparation for your final Arctic service, during which you became the organizer and the creator of Arctic sledge-travelling. You brought your system to such perfection that you and your companion, Lieut. Frederick Mecham, achieved the wonderful journeys of 1853 and 1854—the most wonderful on record. These results afford the strongest proof of the suitability of your travelling equipments.

"With such experience you were the leading Arctic authority when Lady Franklin, forced to complete the search for her husband and his gallant companions at her own expense, secured your services to command the expedition. The voyage of the *Fox* was a great landmark in the history of Geography, whether we consider its conduct, its discoveries,

or its momentous results. There is nothing finer in our naval annals than your firmness and resolution when, after the misfortune of being beset for a winter, and then driven out of the ice in a gale of wind, you coolly turned the ship's head again 'Northward Ho!' You sought no port for refreshment, but turned at once to the battle. Such indomitable pluck commanded success.

"The discoverer of the fate of the *Franklin* bears a name which will never be forgotten by his countrymen. Your book has long been, and will continue to be, one of the classic narratives of our language, recording a great achievement simply and modestly, yet in a way which fills the reader with sympathy and interest.

"It is not for us to refer to your long and valuable subsequent services in the Navy and at the Trinity House; but we may express our deep sense of the value of what you have continued to do in the interests of geography and discovery during a long course of years.

"You have lived to see much valuable and some splendid work achieved in the Arctic Regions, but no one has approached your unequalled journeys, and you still continue to be the greatest, as you are the first, of Arctic sledge-travellers.

"That you may long be spared to us, and that you and yours may continue to enjoy health and happiness, is the earnest wish and hope of your numerous friends and admirers, and, above all, of your old colleagues, who take this propitious opportunity of giving expression to their feelings.

"We are, dear Sir Leopold, yours most sincerely,

"GEORGE TAUBMAN GOLDIE, P. R.G.S.

"CLEMENTS R. MARKHAM, V.P. R.G.S.

"ALLEN YOUNG, Navigating Officer of the *Fox*."

The following reply was received from Sir Leopold M'Clintock:—

"16, Queensberry Place, S.W., July 1, 1907.

"GENTLEMEN,

"I have the honour to acknowledge the receipt of your letter of the 30th ultimo bearing the signatures of the President of the Royal Geographical Society, Sir George Taubman Goldie, Vice-President Sir Clements Markham, and Fellow Sir Allen Young, the latter being, I believe, my only remaining companion of the *Fox*.

"Such a letter could not fail to raise in my mind feelings to which it is quite impossible to give adequate expression. In the exploration of several hundred miles of newly discovered coast-line in the hope of finding survivors or traces of the lost Franklin Expedition, my duty impelled me to exercise to the utmost of my capacity that high sense of responsibility which is characteristic of our Naval Service, and most loyally was I supported by those associated with me or under my command. I only wish that more of my companions were still living

to share with me the gratification of the generous recognition you have bestowed upon us.

"From my heart I thank you, and most grateful am I to you for the manner in which you have given expression to your feelings towards me. It is most touching to find that one is still remembered after so long a time as half a century.

"I remain, gentlemen, yours most sincerely and gratefully,

"F. L. M'CLINTOCK.

"The President and Council of the Royal Geographical Society."

FROM THE NIGER, BY LAKE CHAD, TO THE NILE.*

By BOYD ALEXANDER, Lieut. Rifle Brigade.

In the short time that is at my disposal to-night, I feel that it would be very difficult to give you a well-proportioned account of so large an expedition. As my object must be to give as complete an account as possible, it will be necessary to cover the ground very quickly, so I regret that the scientific results can be only very lightly touched upon.

The first work we wished to carry out was a systematic survey of a portion of Northern Nigeria. Secondly, to explore Lake Chad, and the rivers between the Niger and the Nile, with the idea of demonstrating the wonderful system of waterways that connects the west with the east; and I think this is fairly well shown when I tell you that in the three years which the journey took to complete, the boats were carried for only fourteen days. Together with these primary objects special attention was to be given to tribal distribution and orthography of native names, and a careful study made of the distribution of the fauna to prove its affinity between the West Coast and the Nile.

The party consisted of my brother officer, Captain G. B. Gosling; Mr. P. A. Talbot; my brother, Captain Claud Alexander; and myself. With me I took my Portuguese collector, José Lopes. We were fully equipped with survey instruments.

Captain Gosling was active in obtaining zoological collections; Mr. Talbot and my brother were responsible for the Nigerian survey, for which they had special qualifications; while I acted as leader; so we were well equipped for the object in view. For the river work we took with us two steel boats, double keeled, 26 feet long and 6 feet wide, drawing 1¼ foot for 2½ tons, and made on the Hodgett principle by Forrest Bros. of Wyvenhoe. It took twenty-four men to carry each boat, which was in six sections. It would be hard to exaggerate the importance of these boats to the expedition. In many places they did the work of bullock transport and carriers, that it was impossible to

* Read at the Royal Geographical Society, May 13, 1907. Map, p. 236.

obtain ; and it must be remembered that for so large an enterprise, that embraced so many objects, it was necessary at times to support a large number of followers, sometimes two hundred, who had to be paid and fed. For this purpose a great amount of trade-goods was carried, besides a certain quantity of provisions for ourselves, survey instruments, and photographic apparatus.

The expedition left England on February 27, 1904, and arrived at Lokoja on March 24. Here we organized our transport, collected carriers, and put our boats together, supplementing them with five native canoes. This gave time for Talbot and my brother to get the survey instruments into working order. We left on March 31, for Ibi on the Benue, where the survey work was commenced in earnest, the object being to triangulate through the country north to Bauchi, and connect that place with our subsequent work in Bornu. On our arrival at Ibi, nothing seemed to lie before us but a vast expanse of bush, with no point northward to which we could take observations, except the one ridge of Serikin Kudu. Fortunately, however, one day after very heavy rain, there appeared in the distance a dim outline which we knew could be no other than the Murchison range. Angles were at once taken to some of the most prominent peaks.

On April 23, my brother crossed the river to Serikin Kudu, where he put up a subtense of lights to which angles were taken. On May 3 the survey party left Ibi for the Murchison range. It consisted of my brother and Talbot, with about seventy carriers and an escort of fifteen of the West African Frontier Force. After they had left the valley of the river, the country grew more open. This was much like an English park, except that the grass was higher and coarser, and a good deal of scrub was met with at times. At every place, when the weather permitted it, observations for latitude and time were taken. On the third day the party had to cross the river Simanka several times owing to its winding character. After a three hours' march, they arrived at Kakushi, a large stockaded village, and from here, for the first time since they left Ibi, had a splendid clear view of the Murchison range, and took full advantage of it for fixing points. They now entered the country of the Montoil. These, with their neighbours, the Gurkaua and the Yergum, are pagans and cannibals who live at the foot of the Murchison range. The Gurkaua live among the hills which bear their name, and the Montoil in curious groups of hamlets scattered round the foot of Mount Madong. The Yergum dwell in the extreme east, some at the foot, and some high up on the range. The two latter tribes live, as a general rule, in sets of hamlets, each surrounded by a stockade. Most hamlets contain one family with its different branches. The early state of their civilization is shown by the fact that they have not yet evolved as far as the village stage ; each hamlet is against every other, each village against the next, and each tribe against its neighbour ; the

stronger prey upon the weaker, with the result that the former inhabitants have been driven right up to the peaks of the range, where they now lead a precarious existence. They are very hostile to one another, and are continually raiding their supplanters below to get captives. It was astonishing to see how these pagans had irrigated and cultivated their fields, and taken advantage of every available patch of soil on the hillsides.

On May 9 the party set out straight for Mount Madong, the principal peak to which they had observed at Ibi. At this place my brother was attacked by fever. Talbot tried in vain to ascend Mount Madong, and on May 12 he carried my brother into Wase, where there was a doctor. As soon as Wase was reached, another misfortune befell the party; Talbot became ill with dysentery. At the end of a week my brother was quite recovered, and went out to reconnoitre the Murchison range again, but failed to ascend Mount Madong. During his absence, Talbot, though still very ill, pluckily got up to observe an occultation of the moon, and a most successful result was obtained. Here I must not forget to mention the Wase rock, an immense mass of igneous rock rising sheer out of the plain. It is about 600 feet high, and was probably the tube of a volcano, of which all the rest has been denuded away. It was evident that the best way of connecting the peaks was by triangulation from a measured base at the bottom, and this was eventually accomplished, but not without considerable difficulty owing to the hostility of the Montoils.

The party went on by slow stages round the eastern foot of the Madong mountains, and on June 23 arrived at Langtam, a large pagan village, the capital of the Yergum. Here they managed to get into touch with the people, with the result that the chief and his principal men made pathetic appeals to them to form an alliance to attack three tribes who lived on the top of the mountains, and were the hereditary foes of the Yergum. The party climbed the hill to visit the great Ju-ju place of all the Yergum, the dwelling of a great magician, who pretended to foretell the future to those who brought goats to be sacrificed. He is their last court of appeal in settling disputes and difficulties, and the skins of all leopards and lions are claimed by him. Passing the eastern wing of the Madong mountain, the party found themselves in the Angoss country, where the people live in large villages without any stockades. The country was hilly, with numbers of isolated rocks like that of Wase, and so hard was the ground that the hoofs of he horses were worn down to the quick. In these parts they came cross an extraordinary amount of mica; the path followed shone with like silver, and on either hand there were great peaks of it. In such tony soil it must have been difficult to grow crops, and the whole l was mapped out into little terraces, built to hold up the rain as it down the hill, and prevent the soil from being washed away.

The next important point was Mount Ampang, which is over 4000 feet high. The party climbed this, and found a large plateau at the top covered with populous villages. There was a splendid view; to the north-west lay a magnificent range with peaks 5500 feet high. This has been named the Claud mountains in memory of my brother. From here the progress was slow; several deep rivers had to be crossed, the Gital, the Kamal, and Zungar, with swift currents and much swollen by the rains.

After arriving at Mount Zungaru, nine days were spent in taking observations amid many difficulties from fever, scarcity of food, carriers, etc. On July 26 Bauchi was reached, and here the party stayed three

KERRI KERRI COUNTRY.

days, fixed the position of the town, and made a connection by triangulation with Mount Buli. The expedition then passed through the hilly ironstone country north-east of Bauchi, over the river Gongola.

From the top of a hill called Kalam some curious peaks, in the direction they wanted to follow, were discerned lying some 35 to 40 miles off along the horizon. The village of Alia was reached on August 10. From here, after an eight hours' waterless march, they came to some most extraordinary country belonging to the pagan Kerri-kerri. It is only necessary to describe the town of Gamari, as it will be found typical of all the rest. Amid an alluvial plain rises

a huge circular mass of chalk with precipitous cliffs stretching sheer up on every side. At the top, 300 to 500 feet above the plain, the mass forms an absolutely level plateau, crowded with villages. In the midst of the plateau, again, rises a very steep peak of ironstone or laterite, which for about 50 feet mounts by huge steps or terraces straight as the walls of a house. In the first terrace a series of deep narrow wells have been dug; these completely encircle the peaks at a distance of 10 yards or so from one another. From the top of the peak a most wonderful sight presents itself. One looks down on to the plateau and sees clusters of hamlets, each surrounded by a little wall of matting. Among them, and particularly along the edge of the

KERRI KERRI GRANARIES.

cliff, are curious mud granaries, something of the shape of an elongated beehive, and covered with a neatly plaited straw cap to keep out rain. They are raised above the ground like hayricks or corn-stacks in England, and their height varies from 20 to 30 feet. The grain is extracted by means of a boy, who climbs up a ladder on the outside, takes off the cap, and, jumping in, passes out the corn to men who have mounted to receive it. Scattered over the plateau are ponds of water which never dry up, but this is so chalky that it can only be used for washing.

To reach the plateau from the plain, it was necessary to climb up crevices in which zigzag steps had been cut. At the top the barricade

of the stronghold had to be forced, and the plateau was reached in safety. With great difficulty the pacific intentions of the party were explained; then the chief came down, and within half an hour's time carriers and Kerri-kerri were hobnobbing together as if they had known one another for years. The Kerri-kerri are a tall, slim race, and have little negro strain in them. They wear fine clothes made from native cloth, are very good metal workers, and their sword-blades, of peculiar shapes, are finely engraved. From their own account, they have lived on these strange strongholds from time immemorial, and no tradition of an older race, dispossessed by them, has been handed down. Their crops are cultivated on the plains below, but a six months' supply of food is always kept in the granaries already described. Even this plain, however, was well protected, for it was honeycombed with deep trenches, so well covered with thin leaves and branches as to make them quite invisible to any one, even on the brink. These were specially made as a protection against the invading horsemen of Bornu.

The next day, August 12, the party left Gamara and went to Lewe, another Kerri-kerri stronghold. Looking northward from Lewe, a series of tall plateaux stretched for miles, out of which there rose long parallel ridges of crumbling igneous rock. There was not a single point to which observations could be taken. The party therefore decided to double back in a south-easterly direction, and reached Ashaka on August 17. Ashaka was the rendezvous for the expedition after leaving Ibi. José Lopes, with the two steel boats containing all the stores, had already arrived, and Gosling came in ten days later. He had gained the Gongola after an interesting shooting-trip in the Wase district, where he shot a magnificent giraffe, the first specimen, I believe, to be obtained in West Africa. Both Gosling and Lopes experienced considerable difficulty in ascending the Gongola; the river was then at its full, and, flowing as it does at a steep incline, the current was very strong, 8 miles an hour in many places. The whole country was famine-stricken.

And now I must return to my own journey through the centre of Nigeria, where I made zoological collections. On July 30 I arrived at Loko on the Benue, and left the next day for Keffi, travelling through a flat bush-covered country, which, after a two-days' march, becomes broken in places by groups of cone-shaped wooded hills. From Keffi I took a north-easterly direction to a Fulani town named Darroro, at the foot of a lofty hill range, the stronghold of the fierce Kagorra tribe, who are head-hunters. Natives working in the fields are continually being raided by these people, and their heads cut off. Like many of the pagan hill tribes, the Kagorra are strongly built. Their features are coarse and disagreeable, showing a marked resemblance to the tribes south of the Benue. They are keen hunters, and fight with poisoned

arrows. They use small hill ponies, and by means of these keep up a perfect system of communication from one hill to another. They inhabit the hilly country lying between Darroro and Badiko.

After leaving the Kachia and Panda hills, I reached a village named Petti, within the borders of their country. The village consisted of small mud huts, cemented to the projecting rocks of a high hill. The paths to these mud strongholds take all one's energy to climb, and, winding among the steep rocks, are no larger than what a goat would make. In one of their huts I came across a row of human skulls; in others small hill ponies were hidden away. From my camp at the foot of this hill, I watched these curious people squatting in groups

BOAT ON THE RIVER BENUE.

like monkeys basking in the sun, hours at a time, on the great projecting slabs of rock. On one's approach they would suddenly disappear into their rock dwellings.

Lying to the west of the Kagorra country are the Kachia and Panda hills. They are a continuous range, and run in a south-westerly direction, forming the watershed of the Gurara and Kaduna rivers. Living in these hills are the Kachia pagans, amongst whom marriage customs are not recognized. Nothing but leaves are worn, but the women use a curious ornament, encased in brass, 8 inches long, cylindrical in shape, and made of twisted rope. This is hung down over the lower part of the back, and is kept in position by a string round the loins. It has a curious effect, and at a distance gives one the impression

of a tail. The lips of the older women pout out beyond the nose, caused by rounded pieces of wood (the *pelele* of other regions) inserted into holes in the upper and lower lips. Their bodies, even those of the babies, are smeared over with red clay. For three days my route lay through the fertile valley of the Kaduna, and then, turning eastward to Bauchi, I traversed a thick bush country whose predominant features were groups of flat-topped granite hills, sparsely covered with trees, and generally rectangular in shape.

Most of the towns are pagan Fulani. The intermingling of the Fulani race with their conquered pagans makes it difficult now to trace the Fulani shepherd of olden days. He survives only in the cow-Fulanis, who lead a nomad life, living entirely in the bush. These people travel in small bands, driving their flocks from one district to another, according to the seasons and supply of water. They seldom approach the towns, but form small markets on certain days where the people of the adjoining villages can come and buy their milk and butter. Cowries are only taken, and silver is refused. The women are handsome, tall, and pale skinned, their oval faces half hidden by thick twists of silky hair falling over the shoulders. On more than one occasion I came across these nomads holding markets by the roadside.

From Bauchi I journeyed by Goram and Ako to the river Gongola. The towns in this district are all Fulani, with a mixture of Hausa. At Ako I witnessed, for the first time, the Hausas wrestling. Towards sundown the whole town repairs to the market-place, where a large ring is formed. At one side the king and his courtiers are present. The wrestlers are naked except for the short wrestling-skirt of cloth, gorgeously patched and ornamented by cowrie-shells and tails of the chase. The wrestling is carried out to the accompaniment of drums, whose beats increase in volume as the match becomes more exciting, great yells of approval now and again going up from the sea of black heads. The women whom the wrestlers are fighting for cheer them on by a continuous clapping of hands. Before wrestling, hands are shaken and umpires appointed. In every move the wrestling is Romano-Greek, and in all probability the mode has come through from Egypt after the Roman occupation, picked up by the travelling Hausa in the markets and bazaars.

On October 9 I entered Bornu on my way to Yo. A thirsty trek of seven days brought me to the Yo river, sometimes known as the Waube, or Komadugu. The latter is the general name for rivers in this part of Africa. At Geidam, where I struck the river, it is about 40 yards wide, with a sandy bed and an average current from $1\frac{1}{4}$ to 2 miles an hour. This picturesque little river with its winding course is the sole artery of Northern Bornu, so naturally attracts the life of the country to its banks. To the south there lies a barren and waterless belt of 30 miles in width through the length of Bornu. So refreshing

and unexpected is the sight of this narrow river, with its deep waters and clean-cut banks, that it strikes one as being quite out of place in a country of undulating sandy plains, whose surface is broken by thickets of mimosa, cactus, and burnt-up grass. Along the banks there are occasional backwaters, evidences that the river overflows when the rains are heavy in June and July. Near its mouth the river divides into three channels, and navigation into the lake is impeded by a bar of sand, caused, no doubt, by the influence of the north-east wind across the lake. This river is now the boundary between us and the French. The inhabitants, who are the Mobburs, are now found in greater numbers on the French side. This is due in a great measure to the fact that they have not forgotten the oppression of former days, inflicted on them by the Kanuris, whose rule was predominant in Bornu, and is still in a modified form upheld by us.

On October 26, I arrived at Yo, where I found all our stores and the steel boats. This place, about 30 miles by water from Lake Chad, was to be our next base. The journey of the boats had been successfully carried out by Gosling from Ashaka, where they had been taken to pieces by my collector Lopes, and the sections, weighing some 170 lbs. each, carried to the Yo river, a trek of seven days. Here they were put together again in less than two days, and, carrying all the stores of the expedition, descended the river without mishap to the town of Yo.

We must now go back to the survey party. From Ashaka Talbot left for Mount Zogobi, the needle-shaped mountain which he had observed from Mount Bagi. His route took him through the Barburr country past Gulani, a town strongly fortified against the inroads of the Fulani, who have driven the Barburrs to within their present restricted limits. The latitude of Mount Zogobi was fixed. Thence his route lay in a north-easterly direction, and he eventually reached the territory of the Marraghi. The party moved on to a hill near Arris, and found a dead-level plain lay to the north and north-east, not only without hills, but absolutely devoid of conspicuous points, so the only way of surveying across it was by a rigorous traverse, which was accomplished under the greatest difficulties. Owing to the density of the bush and the want of water, the progress was as slow as half a mile to a mile a day. About this time my brother, coming from Gujba, whither he had gone, mapping the while, to arrange transport of the boat's sections from Ashaka, joined Talbot again, and they continued the traverse to Maifoni. At Dallwa, where it was particularly arduous, necessitating their standing at times up to the waist in swamp, my brother, who only recently had had an attack of fever, collapsed, and for the first time gave in. Then a most unfortunate thing happened. A message from two officials came in, requiring his presence at a point on the Maifoni-Yola road. As the question involved the conduct of the survey, with characteristic thoroughness he considered it necessary to attend in

person. He got up from his bed and rode to meet the officials, and then returned unable to stand, and in the grip of the illness for the last time he was carried into Maifoni, where, in spite of the untiring efforts of Dr. Parsons and Talbot, who, as physician and nurse, showed a splendid devotion, after a fight of six weeks, he died November 13, conscious and cheerful to the end.

Five days later Talbot and I left Maifoni with the object of carrying out a vigorous traverse to Kukawa, at which place the labours came to an end that are embodied in the map now published in the *Geographical Journal.*

From Kukawa we went to Kaddai, the new base from which we were to carry out our survey of the lake. Here I must remind you of the valuable work which French officers have done in the exploration and mapping of Lake Chad in recent years; but I think it best to confine myself in this paper to my own explorations, and leave it to geographers to deal as a whole with the information thus placed at their disposal. The removal of the base from Yo, distant 36 miles, necessitated several journeys of the boats, so that that part of the shore-line became well known to us. The boats took a course varying from 1½ to 2 miles from the shore, where the average depth of water was 3 feet, with a hard bottom. This was in December. In March the depth was 4 feet, probably to be accounted for by the lake having received its full complement of water from the Yo river. With the exception of a few island stretches of reed with no firm ground, there is good open water about 20 miles in width at its broadest part, and nowhere does the depth exceed 4 feet. The shore here is quite open, with rough grass frequented by kob, gazelle, and large herds of hartebeest. It has an average width of 1½ mile, and beyond that there are thick woods of mimosa. There are gentle bay formations all along the shore, and the slope of the land to the water is so gradual that there are no banks, and except in one or two places, the lake can be reached without difficulty, for there is scarcely any marsh, and the land is firm with a sandy soil.

We made preparations to gain the eastern shore of the lake. Our crew consisted of eight men as polers. It was necessary, moreover, to travel light, and two camp-beds and enough food for five days completed the equipment. Accordingly, we left the next day with the intention of striking in a south-easterly direction. We soon discovered there was none too much water; only an average depth of 1½ foot could be found. During the first 12 miles it was impossible to go south; a great barrier of dense marsh lay to our right. Hoping to find an outlet, we followed this belt as close as possible, but were eventually compelled to take a north-easterly course, the marsh giving way to continual low-lying land in the form of bays, in many places unapproachable owing to thick mud. Our prospects the first day were anything but bright, and the impossibility of getting into touch with the Buduma did not improve matters.

Towards sundown we sighted a large fleet of canoes lying in a reed-girt bay, and evidently engaged in fishing operations. Here was our chance. They had not observed us, and under cover of the growing darkness we stole silently along under the lee of a promontory, and came within 500 yards of them. Then a great commotion followed. The canoes were drawn up out of the water, and boats and men disappeared into the reeds. The next day the water to our left became studded with innumerable small sandy islands, overgrown with tall grass, and many strewn with shells. Our course now lay in a strait, where from bay to island the distance averaged 2 miles. In the vicinity of the islands, the

BUDUMA CANOE.

bottom was shelly, sometimes firm, but more usually with a layer of soft black mud, varying from 6 inches to unknown depths. Throughout the day a strong north-east wind was blowing. In one way, we were thankful for this, for it scattered the great hordes of mosquitoes that usually made our life a burden to us at night. On account of these pests star-work was impossible, and consequently latitudes had to be taken during the day. After this strong wind, we were dismayed to find the next morning that the water had fallen 10 inches, leaving a depth of barely 9. For several days we toiled along with hardly any progress, the boat often scraping along the thick mud. Our hopes were more than once raised by the sight of what we took to be Buduma settlements on the land to our right, but on approaching these, they turned out to be

deserted cattle-stations, which consisted of reed-built huts very small in circumference, not more than 4 feet high, and the sides towards the prevailing wind always plastered with mud.

By now we found that our provisions had run out, so to procure food we frantically waded up to our waists in mud after duck, which, before so strange an invasion, immediately took refuge in flight. We therefore had to pay our attention to the flocks of kittiwake gulls which often circled about us, and it was not long before we had spitted and roasted some before the fire in our boat. The following evening, however, our plight became serious, for cartridges were almost finished, and we were obliged to make for rats, which abound on the islands, digging them out of their holes and making humble pie of them, and this is how we lived for another six days, ever hoping to find a passage to the east; but, realizing at last the necessity of bringing our trip to a close, we changed our course to west, and after a tedious winding through a network of islands, we merged into open water with a depth of 2 feet. This continued for a distance of 15 miles till the Yo mouth was reached, where we encamped on a small island, the site of a Buduma fishing-station, which presented a picturesque sight. There was a fleet of some twenty canoes, many full of dried fish; while hanging from frameworks of poles was fish in the process of drying. These stations are "bagas" or markets of the Buduma, where the inhabitants of the Bornu villages repair on certain days in the week and buy the dried fish with their grain, which is not grown by the Budumas. The fish is mainly caught in nets, but the larger ones of 2 feet and upwards in length are speared. Their canoes, made of thick bundles of dry reeds tied together and turned up at the prow, are most picturesque. A good canoe, which takes about a month to construct, will last as long as two years. They are generally 18 feet long, and about 3 feet wide. Lighter canoes are also made, for travelling over shallow water and for escapes from sudden attack.

On December 23 we arrived back at Kaddai, where Gosling awaited us. Here Talbot bade us farewell, taking home with him all the materials for the construction of a map and many zoological collections.

By the middle of February, Gosling, after elephant-hunting near the shores of the lake, where he obtained a fine animal, left with a transport of bullocks for Kusseri, our next objective, and a week later I started with the two steel boats well equipped to endeavour once more to find a way across the lake to the Shari. I again took the direction of the Yo mouth, passing an island on the way, where I counted a herd of sixty hippopotami that had been driven to the lake by the falling of the river. Beyond the river I traced good water to the depth of 4 feet as far as a promontory where the shore-line receded to the north-west, forming a large bay. From this point I struck a north-east by east direction. At a Buduma fishing island I induced two boys to come with me as guides. For 16 miles I found good open water, with

an average depth of 3 feet, and then my course lay through a mass of small islands, with a depth of 1 foot over unfathomable black mud. We struggled on for 10 miles, the men often wading and pushing up to their chests in mud. Then the depth of the water decreased to 6 inches, and as darkness would be falling in two hours, with a supreme effort, we just managed to get the boats in time to an island some 800 yards distant. The next morning I found that we were near the east shore of the lake, for there were horsemen to be seen on the land

BUDUMA, LAKE CHAD.

about a mile beyond the island. I also found that the two Buduma boys had taken advantage of the nearness of the land, and had decamped during the night with the blankets of two of the men. We were all astonished, for there were their footsteps in the mud, where our men had waded to the chest, so that they had run over the mud like moor-hens.

My next course was in a south-easterly direction, among innumerable islands, through which I struggled for fourteen days. My difficulties

were increased by the Harmattan, which was blowing very strong at this time. It would rise daily at 9 a.m. and by twelve o'clock the sun would be blotted out by a dense, damp mist, through which we had to grope our way, miserably cold. To show how strangely the water shifts with the wind, one morning, in retracing our course of the evening before, we found the water had gone, leaving numbers of fish of enormous size, some 4 feet long, stranded. As I could find no passage southward, and my men were worked out, I decided to retrace my route to Kaddai and refit for another attempt.

On March 20 I took the same course as our first journey, hoping still we had missed the passage, but our estimate of the impassability of the reed-belt to the south-east was only confirmed; to be absolutely certain, I decided to try and cut a passage, and for that purpose returned to a point about 5 miles east of Kaddai that seemed the most favourable. On the outward journey we came upon a large Buduma fishing fleet for the first time. As we were in great need of a guide, we made in their direction. At first they mistook us for other Budumas, whom they considered as easy prey; for it is their habit to plunder one another when they get the chance. Accordingly, they closed up ready for attack. But soon they realized their mistake, and the tables were turned. Before we could get up to them—and the crews of the boats were straining every nerve—many of the boats burst out into flames, and the Budumas, swimming like otters underneath the water, disappeared into the reeds. The boats were piled up with dried fish, and hidden underneath straw mats we found four slave boys, who were the victims of a traffic carried on between the Budumas and Tubus. They were in a shocking condition, and we took them back and released them at Kaddai.

But to return to our attempt to cut through the reeds. We worked steadily for two days, cutting a distance of about 800 yards, and beyond that I waded a mile, but there was no end to the reeds and "maria" bush. On this journey we came upon a most strange discovery, actually within our course. Sunk just below the surface were the remains of a boat, which the boys hailed at once as those of a white man's, and they were right. It was made of oak, and some 8 feet long, and must have been in this position for years. I can only think it was the English-built boat which the traveller Overweg is known to have taken out with him some fifty years ago.

I now abandoned this my third attempt, and once more returned to Kaddai. When within half a mile of the shore, we found the water had disappeared, and as it was late, and we were too exhausted to attempt to drag the boats over the intervening mud, the men slept in the boats, and my bed, with mosquito net adjusted, was put up in 6 inches of water, and that night I slept on the floor of the lake. In the morning the water rose earlier than I did, and I had just time to

get out of bed as the lake was getting in. The wind was now blowing, and after waiting for two hours there was enough water to carry us in.

The next few days were occupied in taking the boats to pieces. In the mean time I trekked by the shore-line of the lake due south, and explored every corner in the hopes of finding an outlet, and it was not till I discovered a Buduma fish market, called the Kaua Baga, or Seyorum, 25 miles from Kaddai, that I once again saw open water. Between Kaddai and this Baga the whole shore-line is a vast reed bed, and no water for miles can be seen, but large billowing clumps of maria bush 12 to 20 feet high alternating with tall reed.

CUTTING THROUGH REEDS, LAKE CHAD.

Desertion and sickness amongst my party became rife, and I found myself left with only seven men. By many tedious journeys, carrying the sections along the shore of the lake, over rough ground and marsh, I eventually, after one and a half months, got everything up to the Kaua Baga. On reconnoitring the water from this place, I found a depth of 4 feet, and that it was nothing more than a large bay, enclosed on every side by great belts of reed 5 to 6 feet high. A day's cutting through the reeds and maria bush for nearly 2 miles in a north-east by east direction brought me into a series of large bays of the same aspect as the first. Here the depth was 3 feet over very pale grey mud. The next cutting, 6 miles in length through tall reed growth, papyrus, and maria bush as far as the eye could reach, occupied two

days. During these operations we were obliged to spend the nights huddled up in the boats. Sleep was out of the question. We were attacked by hordes of mosquitoes, and we prayed for the morning to come. Many of the men, maddened with pain, preferred to sit up to their necks in water all night. I observed three species of mosquito, one as large as a small fly, very dark, and with a transparent body, which grew to enormous proportions when distended with blood. In spite of all these mosquitoes, I never experienced a day's fever when on the lake.

In the course of the work the men discovered a gigantic turtle, nearly 100 lbs. in weight, with a shell of a pale lemon colour. On getting through the reeds we found good water, averaging a depth of 5 feet. The aspect of the lake was now quite different from that of the Yo basin. The small, low, flat islands of the latter gave way to big island stretches, which formed continual promontories ahead, overlapping one another on either side of our course, with channels sometimes not more than 100 yards wide; at other times forming deep bays as much as 2 miles in width, lined with belts of dark green maria 10 to 30 feet in height, and relieved by the reddish-brown feathery branches of a thornless acacia. Up to this time the Budumas had held severely aloof, but now a kachella, or chief, of a large fishing fleet we met saluted us, and offered to show us the way to the other side. On the way he took us to his island, Karraragga, where we rested for two days. This island presented a very fertile appearance; the delicate green of young mimosa leaf was a pleasant sight after the sand-swept stretches of Bornu, and large herds of cattle roamed about at will. The kachella's town consisted of reed-built huts, conical in shape, right down to the ground. Each dwelling had its low round mosquito-proof house covered with close-woven matting.

The Buduma, or Kuri, as the Arabs call them, all speak Kanuri. They come close to the Kanembu, with whom they intermarry. The men are tall, often over 6 feet in height, with well-developed heads and foreheads, but blunt noses, and living as they do on fish, their skins are very sleek and oily. The women are small, and resemble the Kanembu in their headdress—well-oiled plaits of hair hanging down all round the head, with a raised ridge down the centre, and they ornament the twisted curls with shells and silver rings.

On the fifth day, I arrived at Wunnda, a Kanembu town on the east side of the lake, a most desolate-looking country, full of sand-dunes covered with scrubby mimosa. From here I followed the shore for some 25 miles, and then a south-westerly course brought me eventually to the mouth of the Shari. This course was made complicated by extensive belts of maria that frequently closed together and made the waterway winding and narrow. In these channels we found 9 to 12 feet of water. About 12 miles before reaching the Shari mouth, one leaves the great

sombre maria belts behind and comes out into magnificent open water, and Chad for the first time assumes the grandeur of a lake.

Before leaving Lake Chad, I will attempt to give a general idea, based upon the observations I was able to make. As regards the size, I made it considerably less than it was formerly supposed to be. For instance, the northern part, which used to be marked on the maps as 60 miles across, I found to be not more than 40 miles, and my journey across the centre made it about 70 miles. There is an idea that the lake is drying up, but my opinion is that it does not alter very much, and I believe that the supposed greater original area is simply

BUDUMA CATTLE STATION.

due to inaccurate survey, and partly to the fact that the villages on the Bornu side are several miles distant from the lake, which has given the impression that these determined a former shore-line. But I think that the sole reason for their position is one of security, for, as there are no containing banks, and the land and water almost level, the Harmattan, which causes the water to flow 600 yards over the land with an ordinary wind, drives it as far as 2 miles when the wind is strong. Besides, I was told by the King of Kaua, a town situate 11 miles from the lake, that in a great flood twenty years ago the water had reached as far as the town, and in another seven years ago it had risen past it and covered the plain as far as a place called Mongonnu. While the floods lasted, the Budumas went up in their boats and established a fish-

market just outside Kaua. Now, on the eastern shore, where there are good banks, and the water is not influenced by the prevailing wind, there are many villages close to the lake.

Another fact that has perhaps created the impression that the lake is decreasing, is that chains of islands that once were separate are now more or less joined together by marsh. But I think that this may very likely be due to the silting up of mud and sand against the obstruction of the islands by the opposing influences of the Yo and Shari, the two rivers that feed the lake. In fact, my observations go to show that the lake is practically two lakes, divided by the 25 miles or so of marsh and maria bush that I attempted to cut through, and these form the separate basins of the two rivers. Moreover, a Buduma chief told me that there was no communication between the two parts, and I found that the people on the different sides knew little of each other. This impression is further borne out by the very marked difference in the character of the scenery and the people. On the north, the shores are flat and bare, and the surface of the water, which is nowhere more than 4 feet deep, is broken up by innumerable small uninhabited islands that are little more than sand-flats. The people are neither numerous nor flourishing, and lead a more or less piratical, lawless existence. But in the south or Shari basin, everything has a more flourishing appearance. The depth of the water is from 5 to 9 feet, and the islands, which form prominent features, are fertile and thickly inhabited. Everywhere the maria tree grows luxuriantly, and its close dark foliage gives a sombre character to the scenery. This is the real home of the Buduma, who are a prosperous enlightened people, gaining their wealth by fish and potash, and counting it in numbers of wives, slaves, and herds of cattle.

Previous to my work on Lake Chad, I had the fortune to witness a Tubu raid upon the Mecca caravan. At that time the Yo districts were in a most unsettled state; natives went about fully armed, and only travelled by night, for fear of the Tubus, who were on the war-path. These people are the nomad robbers of the Sahara, and lead a camp life. Armed with long spears, and mounted on small quick ponies and camels, they cover long distances, concentrating suddenly when a raid is contemplated, afterwards to scatter and as quickly disappear. Many of the lawless Mobbur are their worthy allies, acting as spies, and sharing a portion of the spoils. While the last great Mecca caravan was travelling through this country, escorted by the Kachella of Yo and his horsemen, it was heavily ambushed near Bulturi, a two days' march from Yo. The Mobburs opened the attack by flights of poisoned arrows, while the Tubu horsemen charged on the flanks, cutting off numbers of the flocks of the caravan, which spread over 2 miles of road, and numbered seven hundred people and nearly a thousand cattle. With the loss of twelve men and thirty horses killed, the Kachella, who had eight spear-wounds, with his hundred horsemen, kept the enemy

at bay, and, under the protection of darkness, brought the harassed caravan into Bulturi, where for five days the Tubus hemmed it in. On the fourth day the Kachella managed to get a runner through to me, and begged me to come and rescue him. Accordingly, with all the arrow-men and horsemen I could muster at Yo, I reached Bulturi in time to relieve him. At daybreak we moved out of the town, prepared to fight our way back to Yo. It was splendid to see the Kachella, man over 6 feet in height, mount his horse, and receive the homage of his warriors. First came troops of arrow-men, who silently advanced and shook their bows at him; then the horsemen, clad in cloaks ornamented with patches of colour, upon horses dressed in thick arrow-proof coats, came on in line, and, raising their spears above their heads, formed round him. For nearly two days a running fight ensued, and the caravan toiled painfully along, enveloped in the dust of charging horsemen. It was a picturesque sight. Whole families were there, driving their flocks, and carrying with them all their worldly belongings, and their children, perched on the backs of bullocks and camels. Amongst this pilgrimage there travelled pale-faced Fulanis, Hausas from Sokoto, handsome dark-skinned people from Melle and Timbuktu, and many Mallams or priests, turbaned and clothed in white, walked, calm and heedless of the danger, incessantly telling their beads. When close to Yo the Tubus cleared off, and the Kachella's warriors concentrated and advanced past me in a long line towards the town, and then the women and childen crowded round the king, asking the news. All night long the hours were broken by the wail of women calling upon their dead men to return.

To go back to the forward movement of the expedition. On May 26, after three months' exploration of the lake, I reached the delta of the Shari, which is composed of two main channels and three smaller ones. In May the main stream had 3 feet of water at the mouth. Before reaching the delta, the isolated rock, Haja-el-Hamis, barren and volcanic, meets the eye. The Kuri or Buduma, who live at the Shari mouth, say that seven years ago, during the rains, the lake washed the sides of the rock, which is some 4 miles away. Ascending the Shari, then at its lowest, with fine steep banks and an average width of 500 yards, we travelled through the land of the Kotokos, the giants of the Sudan; and at Gulfei, the big Kotoko chief, some 6 feet 3 inches in height, received us with all his infantry and horsemen. Like all the Kotoko towns, Gulfei is extremely well built, surrounded by a thick mud wall, some 15 feet in height, and many of the houses are two-storied. They are generally built on rising ground, with the king's quarters on the highest point, where a drum is kept to give the alarm. Many of them are in ruins since the invasion of the Kotoko country by Fadre-el-Allah, Rabeh's son. The people are industrious, cloth making and dyeing, fishing, and farming occupying their time.

After leaving Fort Lamy the river has a winding course, with an average width of 800 yards, now and again widening out to a mile. In places the banks are well wooded, and remind one forcibly of our English woodlands, with well-grown trees, shady glades, and green grass underfoot, the resort of game and much bird life. Throughout its entire course the river flows through a very flat country, much of which is under water during the heavy rains. Away from the banks the trees are mimosa, which in the neighbourhood of Fort Archambault give way to Senegambian brush growth, and hitherto sandy soil becomes rich and of a reddish colour, which lends a picturesque appearance to the steep banks of the river. By the middle of June the river rises considerably, and by July, when the rains become continuous, it rises rapidly about 10 inches a day.

Beyond Miltu the flat expanse of country is for the first time broken by an isolated group of wooded ironstone hills, known as the Togbau, about 300 feet in height, abutting on the left bank of the river. From the top a vast view of a barren country presents itself, and my mind was at once carried back to a similar occasion, when I viewed the landscape from the top of the Keffi hills in Nigeria, and I could not help being forcibly struck by the contrast of the two scenes. There as far as the eye could reach stretched wide fields of yellowing corn, whose surface was often broken by clusters of hamlets where dwelt the happy harvesters, while here on all sides to the distance lay a barren stretch of bush and sand.

From Fort Lamy onwards the Shari region is thinly populated. Between Busso and Fort Archambault there are no villages, and the magnificent river flows through a silent land, untouched by traffic of any kind, and one can travel for days without meeting a single native canoe. Regarding the natives, those on the right bank belong to the kingdom of the Bagirmi people, who have carried on for years a systematic slave-raiding against the Sara tribes, or Kurdi, as they are known to the Bagirmi; inhabiting chiefly the country away on the left bank, where they live in small communities, scattering their huts among their crops as a protection against surprise. They are a timid people, but good and industrious farmers, growing chiefly millet and ground nuts; and, what is rare, both men and women work. They may be observed in the fields together, sowing their crops. After the ground has been cleared, the man walks along making a dab in the soil at intervals with his native hoe, and the woman follows with the seed, which she places in the hole and covers up with her foot.

Closely allied to these people, both in appearance and customs, are the Kabba-sara, who inhabit the vicinity of the river above Fort Archambault. Beyond the right bank to the east, the women of the Kabba-sara insert enormous wooden discs 4 inches in diameter in holes bored in the upper and lower lips, and the face is disfigured to such

an extent that it no longer looks human, and the power of speech is reduced to a mumbling. This hideous custom is said to have originated in the mutilations which the women inflicted on themselves to prevent being seized by the sultans of Bagirmi for their harems in the days of slavery. The raids of these Bagirmi sultans, followed by the devastations of Rabeh, have crippled and depopulated to a disastrous extent the whole of the Shari region. This great leader had no less than 60,000 men in the field, who devastated and fed on the land like locusts. Each division of this large army had its foraging-ground apportioned to it each day by the leader.

During our journey up the Shari the amount of game we met with was truly wonderful. On different occasions Gosling obtained elephant, giraffe, buffalo, rhino, hartebeest, bushbuck, duiker, water-buck, roan antelope, kob, ostrich, pig, and wild dog. This was accounted for by the fact that the dry season causes all this game to concentrate near the banks of the river.

At Archambault we found it necessary to collect a large supply of grain, for hardly a village lay in front of us, and our next object was the exploration of the Bamingi river, which flows through a deserted country. On August 6 we camped on a sandbank at the junction of the Bamingi and Gribingi rivers. The former is the larger, having a width of some 50 yards at its mouth. This river was still unknown to the explorer, unless we consider the record of a French trader, named Béhagle, who attempted to ascend it, but at the rapids about 4 miles from the mouth had his boat badly smashed and was compelled to return. He was afterwards hanged by Rabeh at Dikoa. With the exception of these rapids, caused by a reef of rocks across the river, we found the Bamingi excellent for navigation. In August it was at its full, with a depth of 6 to 9 feet and a strong current, which made our progress slow. The river has pretty scenery; the straight reaches are lined with trees overhanging the water's edge, and where the river takes a turn the impinging bank becomes high and steep, and the red colour of the soil lends a pleasing contrast to the green foliage. Sometimes these banks rise to a height of 60 feet formed by rocky knolls, and at these points the growth becomes tropical, with fine-grown trees. For 130 miles, the distance we travelled up this river, we found the country uninhabited, and the impressive solitude was only disturbed by the herds of elephants, which at times frequented the gravelly sandbanks, and troops of baboons that followed us along the banks, gazing in excited wonder at our boats.

On August 26, after a trip of three weeks, we found ourselves again at the mouth of the Bamingi. From here we eventually gained the Ubanghi by ascending the small rivers Gribingi and Nunna and descending the Tomi. Between the Nunna and Tomi a trek of four days with the boat sections across the low Shari-Ubanghi watershed

was necessary. This region is undulating and well watered, and the character of the vegetation changes. Thick belts of forest full of rubber vine hide the streams, and the fauna for the first time belongs to the forest region. The journey from the Shari to the Ubanghi was made under considerable difficulties, from the rains and floods.

The Shari-Ubanghi region is inhabited by an extraordinary number of peoples made up of the Wujia, Munjia, N'Dikongo, and Langassi, all sections or groups of the Banda race, who appear to have been driven down from the north-east by the raids of the Bagirmi sultans, and wars of Rabeh. They are inveterate cannibals, and their religion is Ju-ju. Each village is independent and ruled by a chief, who is the strongest and most unscrupulous man of the community. With the N'Dikongo, when a chief dies a general uproar is made, and all his wives are killed and buried with him. In the case of a headman, his body is buried upon a living bier of half the number of his wives, to the accompaniment of music and dancing.

In this part of the country the natives have a barbarously cruel method of hunting elephants. When a herd is located in the dry grass, all the villages turn out with guns and spears and fire the grass all round the herd. The poor beasts make frantic attempts to break through the ring of fire, and are to be seen rushing madly to and fro in their agony, rooting up trees and throwing grass and earth over their scorched backs. In the Shari region the natives hunt the elephant on horseback with poisoned spears, which leave their heads buried in the animal, whose tracks are then followed, sometimes for two days, to the place where it finally succumbs to the poison.

On October 13, 1905, we arrived at the French post of Krebeje, on the Tomi river, where the boats were put together again; but before leaving, important zoological collections were made in the Kaga Jirri hills, lying some 20 miles to the west of Krebeje. The Tomi river flows through an open country. It is very sinuous, and the overhanging branches of trees make navigation difficult. A journey of four days down the Tomi brought us into the Ubanghi, or "drinker up of little rivers," as its name implies, a great stream some 1200 yards in width, swelling to a mile at the bends. Its banks are fringed with trees, with undulating grass beyond. On either side chains of gentle rounded hills about 150 feet in height, and devoid of trees save in the hollows and ravines, loop sometimes close to the river line and sometimes wind away to a distance of a day's journey. Above the junction of the river Kwango there are large wooded islands, some 3 miles long, inhabited by elephant, pig, and the small Congo buffalo. As one journeys on the aspect of the river changes, and its course winds past wooded headlands that form a succession of bays. At Mobbai the river appears to be a dividing-line between a sterile and fertile land. On the right bank treeless hills, on the left extensive tropical forests, wind the valleys,

which are the home of many elephants and buffalo, and sometimes the haunt of the okapi. From the Tomi to Yakoma there are only two serious rapids—those at Mobbai, and the more formidable Setema rapids, where the river is cut up by rocks and strong currents for 1000 yards.

As regards the inhabitants, space does not permit me to mention more than the Banziris and the Yakomas or Sungoes, whose language is used in the trade of all this part. They are fine races, especially the Yakomas, whose men are veritable giants, and the finest specimens I have seen anywhere in Africa. All along the river there are thickly populated villages, some over a mile in length, and the appearance of the people strikes one as being extremely healthy and prosperous. The Banziris, especially, are keen traders, but salt and small red beads were the only currency, and they would not look at our cloth, for which they had evidently not discovered a use, as their complete nudity showed. The women used the small red beads for stringing in their hair, so thickly that they gave the appearance of their wearing close-fitting red caps. Red seemed to be the fashionable colour with them that season, for their bodies were covered with a red dye painted over an under coating of mud. They are avaricious, and will sell their children for the smallest gold coin. The young girls of the Yakoma race deftly weave long plaited cords of black twine into their hair, which, falling over their shoulders to the ground, gives the appearance of their possessing luxuriant tresses. The ends are wound on a stick like a big ball of twine that weighs 10 lbs., and is carried under the arm, and on the head when at work. The ears of the men have the lobes slit and stretched round an enormous disc of wood $2\frac{1}{2}$ inches in diameter.

On January 1 we arrived at Yakoma, a large Belgian post at the mouth of the Welle, and the next day we left to ascend the river, whose course has a width of from 800 to 1000 yards, studded with rocks, and flowing through an ironstone country, where the natives work mines to a depth of 90 feet. A few days later, in a thick mist, we set out to pass the Voro rapids, about three days below Jabbir, the strongest and most dangerous on the Welle, stretching a distance of 3 miles and sometimes a mile wide, cut up by a maze of small rocky islands, covered with palm trees and tropical growth, between which the water rushes and tumbles headlong through narrow channels, with beautiful cascades falling down on either side. By means of our long boat chain and strenuous poling, we reached the head of the Voro rapids. Here the river is divided into three channels by rocks and islands. To the right a magnificent fall of water roared and swept over giant boulders, the foam flying many feet into the air; while below the swirl of the water made troughs 3 to 4 feet deep. The same to the left, leaving the centre passage, only a little less formidable, to be faced. With superhuman

struggles, the boats mounted and were driven beyond the rapids. The violent uses the boats had now been put to had caused splits to appear, and I was at a loss to find a wherewithal to mend them, till I luckily remembered having seen a native woman mending her pots with the wax of wild honey, and it struck me at the time as so interesting that I made a note of it. And now I tried it with unexpected success. Wooden wedges were driven into the cracks, and then sealed over with the melted wax. The restoration was complete, and Samson's proverb reversed, for out of sweetness came forth strength.

Time does not permit me to give more than a general idea of the character of the Welle. Except for good water between the Angba hill and Niangara, the entire course is cut up by rapids and hidden rocks. As far as Bambili the country on the left bank is clothed in tropical forest, and after that follows a region of grass. The river folk are the Bakango, a numerous people, whose conditions have greatly improved since the Belgian occupation, for its protection shields them from the raids of the fiercer forest tribes.

It was at Angu that we first heard rumours of the existence of the okapi in the neighbourhood, where in the forest, some three days to the south-east of that place, we spent three weeks endeavouring to obtain one. The okapi, or *n'dumba* as it is very widely known by the natives, is very locally found, and Angu is the only part near the Welle where it is met with. We found its haunts were small streams running through swampy ground, thickly overgrown with a clean-stemmed plant, some 6 to 8 feet in height, with large oval shiny leaves bunching at the top, the young shoots of which are an essential food of the okapi. In these localities it roams about singly or in pairs, and, according to the native hunters, three may occasionally be found together. Gosling, although he got to close quarters with it on three occasions, never saw it, so perfectly concealed was it among these leaves. He says, "During the night the okapi will wander along in the mud and water in search of the young shoots of this plant. Here he may be found feeding as late as 8 a.m., after which he retires to the seclusion of the forest, where he remains until dusk. In the glades and clearings I found his spoor on ground frequented by buffalo and water-buck, but this is unusual, for his companions in the forest are more often the elephant, the greater bush-buck, and the yellow-backed duiker." At this time José had been following a solitary animal for three successive mornings in the vicinity of a stream. He observed that, on leaving the water, the okapi always took the same course between two large trees about a hundred yards from the stream. So, with the help of natives, he dug a pit $4\frac{1}{2}$ feet deep between the trees, and then carefully concealed it with branches and leaves. Very early next morning José again approached the stream, and heard the noise of the okapi rushing away. Soon there followed a loud thud, for the animal, taking its usual course,

had fallen into the pit, and was secured. Owing to the thick leaf and forest, its restless nature, and keen hearing, even the natives find it difficult to track, and are obliged to resort to the method of trapping it in pits. They regard the animal as a mysterious creature, and say that it is always moving and never lies down to sleep. José's observations bear this out, for on several occasions, when he heard it feeding, it simply paused to take a leaf here and there and then passed on again.

This portion of the journey was the most trying to the health of the party, the long stays in the hot steaming forest hunting the okapi, and the work on the Welle, which has an evil reputation for being the breeding-ground of bilious and blackwater fever, told severely upon our already weakened constitutions, and we were all attacked by fever. It was at Niangara that the expedition received its last great blow. Gosling was struck down with blackwater, whose deadly attack he laid himself at the mercy of by his refusal, almost to the last, to abandon his labours.

Leaving Niangara with a heavy heart, I further ascended the river and arrived at Dungu, which is situated at the junction of the Kibali and Dungu rivers, and a few days later I left to ascend the Kibali, which has never before been navigated. From Dungu, after 30 miles, the river takes a remarkable bend to the north, forming a loop, and the hitherto flat bush country becomes broken near the south bank by a semicircular group of igneous hills and kopjes, the chief of which is Mount Arama, about 500 feet in height, pepper-caster in shape, and bearing a striking resemblance to the Wase rock in Northern Nigeria. From thence, as one ascends the river, now 80 to 100 yards in width, towards Vankerckhovenville the country directly to the south and east is undulating, accentuated by wooded hill ranges running from west to east, that in places are cavernous and rugged. One of these, the Gaima range, runs parallel to and within 2 miles of the left bank. In this range there are seams of magnetic iron ore, and I observed there were many trees on the watershed that had been struck by lightning. The Momvu, who inhabit these hills, told me that when there were blacksmith's villages on their tops, many people every year were killed by lightning. At the foot of this range, a hut, during a terrific storm, was set on fire, and two of my men knocked down and stunned; and a few days later a heavy thunderstorm broke from the south-east, with hailstones as big as beans.

Between Dungu and Vankerckhovenville there are many rapids, and the navigation of the river was performed under very great difficulties. Our rate of going was often only a mile an hour. Before reaching the Arama hills the formidable Makassa and Bari rapids had to be overcome. The former, 400 yards in length, consist of a reef of rocks across the river, where the water pours down at a gradient of 1 in 2. Immediately below the reef the current is very strong, rushing

and bounding over hidden rocks, and broken like the waves of a choppy sea. One of the boats had a narrow escape of being sunk; the bow was twice below the level of the current, and the water poured in.

As might be expected in the vicinity of the Arama hills, the river again becomes bad, and is much cut up by small rapids with strong currents; then there is a navigable reach of 6 miles through an open country, up to the dangerous rapids of Mangadda, Tzara, and Biti—caused by the proximity of ironstone hills on the left bank, which are practically a continuation of the Arama hills, and form the outside edge of the mountainous country to the south. Beyond the Biti rapids there is a fine navigable reach for 14 miles, with a current of $1\frac{1}{4}$ mile an hour, up to the Andimanza and Kobi rapids in the vicinity of the Gaima range and the river; then does not improve until this range of some 4 miles in length is passed, where a navigable reach of 10 miles brings one into Vankerckhovenville. The Andimanza rapids, which stretch for a distance of 2 miles, present a scene of wild grandeur. The whole river here swells out to a width of 400 yards, and is broken up by small rocky islands covered with tropical growth. Through the narrow waterways the water foams and bounds over hidden rocks and others half submerged, while beautiful cascades, falling over reefs between the islands, pour their waters into the main channel, where series of chutes in successive terraces present a grave danger.

The banks of the Kibali are sparsely populated. As far as the Gaima range there are scattered Azandi and Bakango villages, and then the tribes of the Momvu and Mombuttu, still unconquered, are to be found in the hills beyond the south bank. They build their frail huts of mud on the great slabs of rock, frequently using the caverns themselves as dwelling-places and shelters in time of war, and wherever there is enough earth they grow their maize amongst the rocks. They use arrows, poisoned by a juice extracted from a plant called urri, with leaves much like those of a pineapple, which is found among the rocks of the hills. In these hills I was fortunate enough to obtain from the natives two ancient stone implements. These stones, which are beautifully made and polished, have a rounded cutting-edge and two regular convex faces, and in length are 2 to 8 inches. They bear no resemblance to any of the chipped stones of magnetic iron ore which are only found in some parts of the districts south of the Welle. The districts in which these stones have been found are bounded on the north by the Welle and Dungu, on the west by the frontier of the Ubanghi district, while in the east they have been discovered in the neighbourhood of Dufile and Wadelai. The tribes are ignorant of their origin, and believe they are bolts of lightning which strike trees and kill men. The Azandi call them "mangua n'gamba," or "axes of the lightning," and the Mangbettu "negbara gombe," meaning the same thing. They say that

these axes may often be discovered by turning up the soil immediately a tree has been struck by lightning; a little later it would be no good, because the stone would have gone back to the clouds in order to strike again! Many natives attribute a mysterious power to them, believing their discovery announces a friend's approaching death; and the Mangbettu cherish them as charms, every morning throwing upon them the water with which they rinse their mouths, in order, as they say, to avert trouble.

On July 21 I arrived at N'Soro, which is a small Belgian post with a white officer. We attempted the river Ira, or Bakwa, which up till now has been considered the main stream of the Kibali. But this is not the case, for the N'Soro, which falls into the Kibali some 2 miles below the post of that name, is really the main stream, and at the junction is some 200 yards wide. I found the Ira navigable for 12 miles, with an average width of 50 yards. At N'Soro it takes a sudden turn to the south, and flows through an open, uninhabited country of grass and bush. About 8 miles from the post it makes a remarkable loop to the north, following a chain of volcanic hills called Rangu-Rangu, some 600 feet in height, that run parallel to the right bank. They are inhabited by the Logos, or Bauu. They were given the latter name by the Belgian soldiers, mimicking the noise they made, which was like the howling of dogs, as they ran before the strangers. The natives have now adopted it themselves, and if you ask one the name of his tribe, he always replies "Bauu." The whole way we came upon numbers of elephants, which, so unaccustomed to man, allowed us to approach quite close, and it was a pretty sight to see them playing on the banks and bathing in the water.

Beyond the Rangu hills the river is unnavigable. We struggled for several days up many bad rapids, and eventually found ourselves in the hostile country of the Mombuttu. Their villages were deserted, and we could not get food, and, as the grass was too high for game-shooting, and our supplies nearly finished, we were forced to return and shoot the rapids behind us back to N'soro. Subsequently I penetrated by road into the country of the Mombuttu, south of the Ira. Here the scenery is grand. A mass of mountainous hills rolls away, range on range in glorious confusion, their steep sides darkened with trees, save where they are scarred by clefts and sharp angles of bare rock. And below in the deep valleys the courses of innumerable streams are revealed by their coverings of tropical green. From here, where I climbed to a height of 4000 feet, far away to the eastward on the horizon, I saw for the first time the grey blurr of the hills of the Nile.

On September 23 I again left N'Soro, carrying the boat, with the idea of getting to Faraggi and ascending the Dungu, which the natives told me was the same as the Kibbi, rising in the neighbourhood of Mount Schweinfurth. Two miles to the north of the post the river

N'Soro had to be crossed. It is 120 yards at this point, is unnavigable both above and below, and runs through the country of the Logo, who, with the exception of two of the large chiefs, have not yet submitted to the white man. They are a big tribe, ruled by a nobility, called the Gambi. They are a filthy dirty people, and have some strange fashions. The women plaster their hair with a red mud, and wear a ring in the upper lip like a pig, and a long bone spike in the lower lip, and the lower front teeth are taken out.

I got to Faraggi, and from there tried to ascend the Dungu, but found it quite impossible, so trekked across the country two days' journey, and gained the main road to Yei, a distance in all of eight days from N'Soro. The rise along this road was so gradual that we were greatly surprised, when near Aba, suddenly to behold the huge panorama of the Congo-Nile watershed. Behind us to the south lay the dark green vastness of the Congo forests, whose monotony was here and there relieved by winding partings in its surface that told the courses of rivers. On either side and to the north stretched endless plain with an occasional lonely hill, and far away to the east the sharp peaks of a sierra chain.

On October 13 I arrived at the Yei, and having formed a column to carry my collections to Gondokoro, to ensure their safety as well as our own by lightening the boat, we commenced the descent of the river. At this point the river is little more than a rocky mountain stream, 25 yards wide, and some 30 miles from its source in the Lugware district. For the first 20 miles we passed a succession of rapids in terrace formation, rendered more difficult by the obstruction of small green islands. It was laborious progress, sometimes only a mile a day was made, and the boat had to be got past the rapids by the men hanging on to the chain in the water from the stern. Sometimes trees, fallen right across the stream, had to be cut through. At other times, where a passage allowed, we took the risk and shot the rapids. The boat was now in such a battered condition that frequently after the passing of a rapid it had to be drawn out of the water, a fire lit, and the wax melted, and the wedges renewed. After this difficult 20 miles, the river decidedly improved, with steep-cut banks of soft loam, and after a good navigable reach of 15 miles we came to the Azandi village of Kapi, which was the first populated part we had met with. Here many of the natives bear the slave-marks of the Dervish chief Otrusi—three deep diagonal incisions on each cheek. It was at this place I saw the interesting ceremony of the signing of a treaty between the chief and an ancient foe. They met, each surrounded by his followers, and their headman made incisions in the chiefs' arms, and with a feather mingled the blood of one with the other.

From Kapi for 23 miles the river is good, with the exception of two rapids, the second of which was one of the worst, and certainly the

most disastrous, we had to encounter. Owing to the tremendous current, the men on the chain behind for a moment relaxed, and the boat was driven with terrific force against an overhanging tree. The shock swept off two of the polers, who disappeared into the torrent never to be seen again. José was also thrown into the water, but, being a strong swimmer, gained the bank, while I found myself hanging on to a branch of the tree. The boat was sunk, and only recovered with great difficulty and the extra help of natives the next day. The rudder, however, was lost, and the rest of the journey had to be accomplished without one. In the open reaches of this part of the river we came across numbers of hippos, and their closely cropped feeding-grounds by the riverside afforded us excellent sites for our camps. They were not always successful in getting out of our way in time. On one occasion, as the boat was coming down at a rapid pace into a pool, we were all thrown together by a tremendous bump, and for a moment all thought we had struck upon a rock. But the rock snorted and plunged out of our way.

For the next 6 miles, up to the station of Wandi, the river is quite unnavigable. In places the boat had to be unloaded and dragged over the rocks, so as to avoid the chutes, that were gigantic. The river in appearance ceases to exist, and the water pours itself as best it may over the slabs of rock with which the whole length and breadth are strewn. In this distance there are at least six big rapids, and the last, which is near the station of Wandi, is a veritable chute. At the one before this we had a very narrow escape of being smashed up. We had been going in smooth water for a time, and the men were all in the boat poling, when suddenly the current became strong, and the boat was carried helplessly along, each second nearing the steep of a formidable rapid. The poles were quite useless to check the impetus of the boat, which increased every moment. In spite of the heroic efforts of the men, the boat swung round, and the next instant crashed heavily against a large dead limb of a tree, where it stuck. But for this there would have been nothing to hope for.

It was dusk, and a heavy storm was raging when we arrived at Wandi, dead tired, for it had been a long day of hard conflict with the rocks. Wandi was formerly occupied by the Dervishes, and traces of them are still to be seen in the fine lime trees, now in full bearing, which grow on the sites where their houses once stood. Also there are large numbers of elephant-tusks to be found in the bushes, which the Dervishes left behind in their hurried evacuation of the country, and many of the present people, who are much split up, bear the slave-marks of the powerful Dervish, Otrusi. The tsetse fly, the species that carries the germ of sleeping-sickness, was very much in evidence here, and I saw two cases of the disease. Further on it became still worse, and close to Avurra, which is on the borders of the Bahr el Ghazal

province, I came across two villages that were wiped out by the scourge, and the chief of another was brought to me in a dying condition.

At Wandi the waters of the Yei are swelled by the Tori river, some 30 yards wide at the mouth. For 100 miles after leaving Wandi, to within 40 miles of Avurra, the river flows through a country of poor stony soil and is at its worst; nothing but rapids the whole way, and the one 6 miles from Wandi is the biggest we had yet seen, and presented a splendid spectacle. Here the river is 300 yards across, and a great volume of water sweeps foaming over steep rocks past islands covered with beautiful palm trees, which are the resorts of dog-faced baboons. In the neighbourhood of Raffai appear small hills of not more that 400 feet. These are inhabited by the Misa people, a tribe that struck me as rather original. The men, who are smooth-skinned and gentle, adorn themselves with bead ornaments and girdles of beautiful design, while the women affect a masculine severity of costume, fruit-stones taking the place of beads. At Avurra the Yei becomes a splendid river with a sandy bottom, clean banks, and an average width of 60 yards, and the country throughout is well populated.

It was now December, and the river was rapidly emptying itself; in places there was hardly enough depth to clear the keel of the boat, and it became a race between us and the water. To hasten our pace we threw away all our belongings with a light heart, for our spirits were high, as we had said farewell to the rocks. For about 90 miles to near its mouth the Yei flows through a flat country, well wooded with mimosa, broken sometimes by open grass stretches where large herds of cattle and sheep roam at will. Often along the sloping banks one sees the brilliant green of young tobacco plantations. This is the land of the Dinkas, who on our first appearance ran away, but later, gaining confidence, flocked down to the river and lined the banks in hundreds. All naked and with their bodies painted a ghastly white, they shouted and danced and threw their long spears into the air. So we made 60 miles, then trees, flocks, and men gradually disappeared, and the river wound alone through a vast empty plain. It widened and slackened, and the impression came over me that it was nearing its journey's end. Eagerly we craned our necks for a sight of the Nile, but this reward was still withheld; nothing but marshland as far as the horizon met our gaze. Then the river, which at this point is known as the Lau, broke into two deep and narrow channels, of which only the right held water at this time with a fairly strong current. Between the channels lay a stretch of marsh that broadened to the width of a mile. All round, the land is so low that during the rains it becomes a vast marsh. We followed the channel for some 30 miles, and then the river lost itself in a lake with an area of 4 square miles, surrounded by dense reed and sudd. We crossed the lake with irresistible recollections of Chad, and picked up the

thread of the stream again on the further side. This ran on for another 3 miles, and finally disappeared into the barrier of marsh and sudd which choked our passage to the Nile. It was impossible to cut through, and so I trekked with the boat sections to Ghaba Shambi on the Nile, a distance of 40 miles. I have calculated that my passage of the Yei, by showing it navigable in its lower reaches, proves that it could be utilized to lessen the transport by six days of the food supplies to our garrisons in the Bahr el Ghazal province from Khartum, on which they are entirely dependent. Also it is my opinion that, if the barrier of sudd were cut through, the increase of water to the Nile would immensely improve the irrigation of the Sudan and Egypt; so too with the river Naam or Rohl, which flows more or less parallel to the Yei.

On my arrival at the Nile, I took boat to Khartum, where I paid off the surviving boys, who nearly all joined the pilgrims to Mecca. And so, with our arrival on the Nile, the goal we had set ourselves was reached, and our journey brought to an end, which in distance had extended over some 5000 miles and in time occupied just three years. And my greatest hope now is that its scientific record may in some measure repay the price that was spent upon its achievement, for the expedition paid a heavy toll in valuable lives. And when I think how its success was based on the efforts and crowned by the devotion of my lost companions, and when I realize your kindness in listening to me to-night, I feel it is very difficult for me to speak, remembering the voices that are still.

Before the paper, the PRESIDENT read a letter which H.R.H. the Duke of Connaught had sent through his controller of the household, expressing his regret at being unable to be present, and congratulating Mr. Alexander on his safe return. He then continued: I think, on seeing this audience, that there is no question that Lieut. Boyd Alexander, of the Rifle Brigade, will have a very warm reception. He thoroughly deserves it, for the work he has done has been of a specially notable nature. No doubt the mere crossing of Africa in its breadth between the Gulf of Guinea and the Mediterranean, or the Red sea, or the Indian ocean, is a much less formidable task now than it was in the days of the early pioneers of the nineteenth century, because the partition of Africa from 1884 to 1900, and the gradual spread of effective occupation, have facilitated the mere traversing of Africa from sea to sea. But this was not the character of the Alexander-Gosling expedition; they did not seek, as the early explorers were compelled to seek, the most practicable and quickest routes. On the contrary, like good geographers, they sought out the least known districts; they followed the lines which would enable them to give us the fullest and most complete information on regions hitherto unexplored, and they were three years in completing their work, with the result that they have brought home a mass of information of various kinds, and, as you will see from the maps that have been distributed amongst you, they have explored regions some of which were only partially known, and some of which were absolutely unknown. We lament the price that has to be paid for this devotion to their work, and we deeply sympathize with the relatives and friends who mourn the loss of those whose capacity, whose energy, and whose courage they were justly proud of. I shall not

dwell upon this point, which must be painful to many in this hall; but it would not have been fitting that the Royal Geographical Society, in giving a welcome to the expedition on its return, should have omitted to make any reference whatever to the death of those two most distinguished officers, Captain Gosling of the Rifle Brigade, and Captain Claud Alexander of the Scots Guards. The only surviving Englishman of the expedition who reached the Nile was Mr. Boyd Alexander. You will have heard from us at previous meetings last year, and you will have seen in our *Journal*, the excellent work done in the early part of the expedition in making a survey from Ibi, on the river Benue, to Lake Chad. You will hear from Mr. Boyd Alexander himself such a summary as the limits of our time permit of the whole expedition from Ibi to the Nile, and although Mr. Boyd Alexander has not dwelt at all on personal questions, you will, I am sure, gather from the bare facts he puts before you the extraordinary personal qualities that have been displayed by all concerned, and which are worthy of the high commendation of their countrymen. I will now ask him to give us his paper.

After the paper, Sir Harry Johnston: I did not know that I was to speak here to-night. I was a listener and an admirer of Lieut. Boyd Alexander, whose paper, I think you will agree with me, is one of the most remarkable that has ever been read in this theatre. The three years' journey has been performed under circumstances of difficulty and sorrow, in the death of those to whom he has alluded; but I feel sure that the ultimate results of this great expedition in scientific information will, as the lecturer half hopes, have even repaid the price that it cost. I think that the Alexander-Gosling exploration of Lake Chad was not only remarkable geographically, but was particularly interesting as evidencing the western extension of the Nilotic influence. From the photographs, I was struck with the similarity between the Buduma and other Chad peoples and the Nile negroes in physical features; and in making some researches into the Nilotic languages, I find from the vocabularies of Barth, Schweinfurth, and other travellers that the influence of the Nilotic type of speech can be traced as far west as the Shari river. Another link is the long-horned breed of domestic cattle, which extends from the White Nile and Abyssinia to Uganda and Tanganyika, and also, as we now see, to Lake Chad and the Central Niger—perhaps even to Senegambia. I have only one word to add about the name "okapi." I have been told that the name I conferred on this creature is called in question as simply meaning in one language "a big beast," and being disowned by other tribes. I can only say I subjected the natives to a great deal of cross-examination, and I never got any other name but "okapi" or some word closely resembling it. The word "okapi" actually comes from the Momvu people and the Ituri pygmies. But a creature like that has probably twenty or thirty different names amongst the different tribes, because the many tribes of the north-east Congo forest speak languages differing radically the one from the other.

Sir Ray Lankester: I have had the very greatest pleasure in being present this evening and hearing the wonderful narrative of my friend, Lieut. Boyd Alexander. It is, I think, about a year or possibly little more than a year ago that news travelled through—I do not know how—to the effect that his party had captured a live Okapi, and then came the news that they had got its skin and were bringing it home; and at last, three months ago, Lieut. Boyd Alexander arrived in England with his Okapi, and he was kind enough in a very short time to bring it to the Natural History Museum. It is a very beautiful skin, and it comes from a point in Africa which is about 250 miles to the north-west of the region from which our previous specimens, without definite location, of the Okapi had been brought to notice. This probably is the extreme western and northern range of

the Okapi, and the specimen differs at first sight from that which was brought by Sir Harry Johnston from the Semliki river, being of a very much darker colour and with stripes more numerous, and of creamy white rather than a pure white. There are also certain features about the skull and about the tufts of hair at the tail in which it differs from that first specimen. But perhaps I may be allowed for a moment to digress on the subject of the Okapi. Nearly every specimen of Okapi which comes home differs very greatly from every other specimen. It is one of the most variable animals which has come under my observation, and whether I shall ultimately be able to name this Okapi after Lieut. Boyd Alexander, which would give me the very greatest pleasure, I do not know. I am examining, as far as I can, all the skins of the Okapi which have been brought to Europe, and all the skulls—I suppose at least twenty skins or skulls have come through, and I have knowledge of some twelve to fourteen specimens—and eventually I hope to be able to say something definite on the subject. I think it is a wonderful thing that news should have come out of the centre of Africa about the capture of this specimen. After tremendous struggles Lieut. Alexander had to get home; he had to throw away nearly everything, but the Okapi skin he did stick to, and some other specimens. I wish he had been able to bring his boat here, and I wish the Okapi had been set up in time for this present meeting. I hope I shall see him with it in the Natural History Museum at no distant time. Amongst other things which he brought home there were nearly one hundred different species or interesting forms of mammals, of which my assistants in the museum tell me at least eighteen are new species, and some have been described already. There are some very remarkable rat-like forms, and there is a very interesting small antelope which has been named after Lieut. Alexander's brother, and there are other things. He himself is working at the birds he brought back. To-night we have only had the itinerary, the remarkably personal account of his adventures, which impressed me very much. Of course, there is all the collecting which went on, and the scientific observations, which, no doubt, will first of all come to us in the form of separate papers, but will afterwards be embodied in Lieut. Alexander's book. I can only say that to me it is a very great pleasure to be here, and a very great pleasure to have made the friendship of so remarkable and worthy and heroic a traveller as Lieut. Boyd Alexander.

Dr. Bowdler Sharpe: At this late hour of the evening I can only offer just a few remarks which may, perhaps, add a little to your knowledge of what my good friend Lieut. Boyd Alexander has done. I may tell you that I have known him, I may say, from a boy, and have esteemed him always as a brave traveller and splendid naturalist. I am naturally very proud to be present here to-night, and see such a large body of his friends come to welcome him after his wonderful journey. I have ventured, and so far it has been a successful venture, to divide Africa into zoological regions, one of which is the forest region of Western Africa, which comes down to the Coanza or Quanza river, and then follows the Congo system right up to the Nile watershed. That is the land of the gorilla and the okapi. We know a good deal about the Algerian Sahara and Tunis, but nothing about Lake Chad, and until Lieut. Alexander went into the country, I should not be wrong, I think, if I say we had three specimens of birds on which alone we could give a guess as to the fauna of the lake. Hitherto it has been all guesswork, but I have said for thirty years that the fauna of Senegal would be found to extend throughout the Sudan to Abyssinia, and that it was entirely different from the fauna of the West African forest region. Now that Lieut. Alexander has gone up to Lake Chad and has made a beautiful collection of birds, as you will see from the specimens in the next room, he has proved that the fauna is continuous, as I thought

it would be. Of course, it is a little disappointing from the point of view of new species, but I never expected many; and I can only say, and I am sure he agrees with me, that as every fact he has discovered is perfectly new, and a gain to science, so not a bit of his work has been lost.

Sir JAMES WILLCOCKS: When Sir George Goldie told me he was going to ask me to say a few words, I must own I was somewhat alarmed; but I remembered it was regarding my friend, Lieut. Alexander, who has done such good work, and to whom I owe a debt of gratitude. As I served for two years in the Niger, I think I understand more perhaps than many of those here the immense difficulties Lieut. Alexander must have gone through—sickness, want of food, deserts, swamps—and yet he has triumphed and looks well after it. The country east of Lake Chad, when I was in Nigeria, was looked upon as a land that would never be seen in our days. Lieut. Alexander has proved to the contrary. I remember in Ashanti he was always trying to find something new, birds or beasts, or some parts of the country which the rest of us could not get to, and he has now found something that other people have not been able to find. So long as England can produce such sons and our army such officers, I do not think there is any fear of England losing its first place as a discovering nation, and a nation that helps to civilize unknown lands.

The PRESIDENT: It only remains for us to give a hearty vote of thanks to the reader of the paper.

A JOURNEY FROM YÜN-NAN TO ASSAM.*

By E. C. YOUNG.

THE idea of investigating the country which lies between the empires of India and China south of the Tibetan frontier is one which has long had a special attraction for geographers and travellers, both on account of the possibility of opening up a trade route between the two countries, and more especially because of the comparatively unknown nature of the intervening district; and it is with the object of communicating some information collected by the writer during a recent journey from Yün-nan to Assam that this paper has been written.

It was in the autumn of last year (1905) that, being fortunate enough to obtain leave for six months, I decided to carry into execution a long-cherished design of undertaking the journey I am about to describe. I decided, firstly, to take only two companions, Chinese servants of mine, who had been in my employ for some years, and upon whom I knew I could thoroughly rely; and, secondly, to live almost entirely on the produce of the country I was to travel through, taking only a small reserve of tinned stores for use in emergencies. The two servants were natives of Chih-li province, and it is not too much to say that but for their fidelity and pluck the journey could not have been accomplished. Our equipment and stores, etc., were limited to some five hundredweight of baggage, including a fairly complete outfit

* Map, p. 236.

of surveying instruments, and, thanks to the care with which this kit had been selected, it proved almost perfect in every respect.

On October 1, 1905, we set out from Tientsin (North China), and after travelling by sea to Haifong, passed through Tongking by rail and steamer as far as Lao-kai, on the southern frontier of Yün-nan, from which place till we reached India some five months later the whole of the journey was accomplished on foot.

Leaving Lao-kai on October 24, we travelled through the picturesque and mountainous basin of the river Nan-hsi, following the line of the new French railway as far as the treaty port of Mêng-tzŭ Hsien, from which place survey operations were commenced. We left Mêng-tzŭ Hsien on November 1, and travelled through Lin-an Fu to Shih-p'ing Chou, passing through an undulating country with low rounded hills, which are covered with long grass and sprinkled with saplings and small trees, and with innumerable limestone boulders, whilst the valleys are populous and cultivated. The villages are solidly built, the houses being chiefly of a sort of rough concrete of earth and pebbles, rammed tightly so as to form solid walls about 2 feet thick. From Shih-p'ing Chou we turned northwards, and, after a march of about 20 miles, ascended a steep pine-clad ridge, at the top of which we found ourselves in a rolling upland country some 6000 feet above sea-level, partially cultivated, and with numerous pine woods and occasional villages. Here we encountered a distinct type of native belonging to the aboriginal tribe of I-jên. They speak a language of their own as well as Chinese, and are a peaceful and well-behaved people hereabouts, and subject to the Chinese Government. The men differ but little from Chinese in appearance, but their features are heavier and less intelligent. The women, however, are pleasant-looking people, with aquiline features, and their free independent bearing is in striking contrast with the timid manners and hobbling gait of the Chinese lady. They wear a spotted blue cloth over the head, and have petticoats of dark-blue cotton; they also wear many silver ornaments, large earrings, and necklaces, etc. Leaving the I-jên villages, our route continued northwards through a hilly wooded country, with numerous pine trees as well as crab apple, wild pear, hips and haws, and berries of different sorts. Passing through the walled city of Hsin-hsing Chou, which lies in a broad cultivated valley, we reached the village of Hsin-kai, from which point we turned to the westward.

The trend of the mountain system of this part of Yün-nan is, generally speaking, north and south, so that the traveller whose course is in an east-and-west direction runs counter to the ranges, and experiences a continual series of ups and downs, as when crossing the ridge and furrow of a ploughed field. From Hsin-kai we traversed a comparatively little-used path through a picturesque woodland district, till, after passing a village called Yang-hsing-chuang, we ascended

what appeared to be quite a low range of hills, and were surprised to find, on reaching the crest, that we were looking down over a great expanse of steep mountain-side which was chiefly covered in brushwood. Far below there was a long cultivated valley running north and south, in which lay the town of Yi-mên Hsien, on the further side of which a lofty range of mountains blocked the horizon to westwards. It was our first ridge and furrow.

We made a day's halt at Yi-mên Hsien, a small walled town of about 2000 inhabitants, and then tackled the next ridge which lay to westward. On leaving Yi-mên Hsien the road ascends almost immediately, and within a few miles climbs by a series of ridges to a height of some 7800 feet. From this height a fine panorama of mountain scenery was obtained. The mountains are flat topped, and the slopes are sufficiently gentle to admit of cultivation, and they presented a patchwork of fields which bore evidence of an industrious population. A few miles along the mountain-tops brought us to the edge of a gloomy rugged ravine between steep and lofty hills, at the foot of which a turbid stream of dark brown water tore its way down a shaly slope at an inclination of about 15 degrees towards San-chia-ch'ang, a small village of flat-topped, brown-walled houses, nestling at the foot of a beetling cliff. Here we saw copper smelting works of a primitive type, and the horizontal burrows into the side of the cliff from which the ore is extracted. Beyond San-chia-ch'ang we encountered a series of steep and often lofty hills, over which the path ascended and descended with monotonous regularity. The path was practically deserted, and the few people we saw appeared sickly and poverty stricken. Many of them were stunted and deformed, and we saw numerous cases of goitre and enlarged spleen, as well as what appeared to be "berri-berri." In this rugged country cultivation was scantier and was chiefly confined to the valleys, the hills being either pine clad or covered with coarse grass. It was the end of the harvest season, and threshing was going on. Sometimes this is done with flails, and sometimes by striking the paddy over the edge of a large circular saucer-shaped basket, so that the grain falls into the basket while the straw remains in the thresher's hands.

As we journeyed west the mountains increased in height, cultivation was less frequent, and the country more thickly wooded, until we reached Nan-an Chou, from which point, turning northwards again, we passed through a few miles of undulating pine-clad uplands, descending into the valley of C'hu-hsiung Fu, where we halted.

The route from C'hu-hsiung Fu to Ta-li Fu is so well known that I need not attempt any description of it here. The road was good—as Chinese roads go—the weather perfect, and the scenery picturesque and striking, and we enjoyed a rapid and interesting march of six days between the two towns, arriving at Ta-li Fu on November 25. At Ta-li Fu we halted for a week, in order to make our final preparations

for the advance into the unknown regions of the Salwin river. Mules were now discarded, and loads were made up suitably for coolie transport; dollars, which had hitherto been our currency, were now melted down and turned into the small conical lumps of silver which are known as "sycee;" fur clothing was purchased, and also a supply of local provisions—hams, tea, sugar, etc.—which, together with our tinned European stores, were estimated to last us for about a month. Whilst at Ta-li Fu I received a letter from the British consul at T'êng-yüeh T'ing, the late Mr. Litton, warning me of the disturbed state of the tribes on the upper Mekong and in the neighbourhood of Wei-hsi T'ing, where a Tibetan raid had recently taken place, during which four

VALLEY OF THE MEKONG, LOOKING SOUTH FROM NEAR FEI-LUNG-CHIRO. TERRACED RICE-FIELDS IN FOREGROUND.

French priests had been murdered, and the mission stations destroyed, whilst the repressive measures of the Chinese authorities had only served to aggravate the state of affairs.

We left Ta-li Fu on December 3, and proceeded northwards over a stone-paved road along the west side of the Erh Hai to Shang-kuan—the upper customs barrier on the approaches to Ta-li Fu—and then on to Têng-ch'uan Chou, which lies at the head of the lake. From Têng-ch'uan Chou we turned west, and ascended a pass in the lofty range of mountains at the foot of which Ta-li Fu lies. From the top of the pass we looked down into a long slanting valley, with the town of Fêng-yü below us. The hillside was so steep that the

valley appeared as though seen from a balloon. It was closely cultivated, and the little banks which edge the fields and serve to regulate the irrigation water looked like the squares of a chessboard. A stream wound in a silver streak from south to north, peasants were working in the fields, and numerous villages were visible; but the height from which we viewed it precluded the sounds of rural life, and the scene was a silent one. Descending into the valley, we rested at Fêng-yü, and from there ascended the Lo-pin Shan, a mountain of 10,100 feet, whose summit is said to be the abode of evil spirits, who, however, have a virtuous objection to bad language and noise, so that travellers must be careful what they say when crossing the pass, lest the spirits should send fogs or storms or other visitations to punish them! A similar belief is common in other parts of Yün-nan, and I shall have to record the existence of kindred superstitions which we observed at a later stage of the journey.

From the summit of the Lo-pin Shan, looking westwards, we saw ranges of thickly wooded mountains running north and south stretching to the horizon, but were relieved at the absence of any snow-clad heights in front of us, though behind us, to eastwards, the summit of the Tal-li Fu range was powdered with snow, whilst to north some glittering snow-clad peaks near Li-chiang Fu were plainly visible. Descending the pass, we now followed the course of a tributary of the Yang-pi Ho, and entered a thickly wooded but sparsely populated country, where for two days we marched through beautiful autumn-tinted forests of oak and walnut and fir trees. Occasionally we met caravans of mules and bullocks carrying firewood or salt, the latter commodity being in small cylindrical cakes about the size and shape of a pint-pot, but with Chinese characters moulded on the top. The foot-passengers we encountered were said to be Lolos, and were almost always goitrous and dirty. Generally they wore a skin over their shoulders, with the fur outside, and their legs were encased in ragged knickers or drawers, with cotton putties wound loosely round the lower part of the leg. Their unkempt locks were bundled away under a scanty turban or puggri. The women we passed were dressed so much like the men that we had difficulty in distinguishing them, except by the jade earrings they wore, and by the fact that they were cleaner and of more pleasant features than the men. The few houses we saw were log cabins built of unshaped pine logs, and roofed either with pine shingles or thatch. As we continued our way westward the average height of the mountains increased, though the Lo-Pin Shan was still the highest point we had crossed. We reached Yüng-lung Chou on December 9, and after a day's halt proceeded to Fei-lung-ch'iao, on the Mekong, from which point survey operations, which had been discontinued since Ch'u-hsiung Fu, were recommenced.

At Fei-lung-ch'iao I was, unfortunately, not able to take a cross-

section of the Mekong, but I observed that it was 235 feet wide at the bridge, and a sounding taken from the bridge in mid-stream gave 25 feet as the depth at that point. The water was clear and of blueish-grey colour; the current was strong, and rocks and rapids above and below the bridge rendered navigation impracticable. The famous suspension bridge is a single span bridge of 235 feet clear span, with a plank road-way 8 feet 3 inches wide, supported by twelve chains of 1-inch iron. Two similar chains form the top of the handrails, which are of wood. The chains are in groups of three, there being three double chains on each side. The height of the roadway above the water-level at that time was 44 feet at either end, and 37 feet in the centre.

RIVER SALWIN ABOVE LU-KU, LOOKING DOWNSTREAM SOUTHWARDS. BAMBOO RAFT FERRY IN THE FOREGROUND.

From Fei-lung-ch'iao we ascended the right bank of the Mekong for a few miles, and then ascended the lofty range which divides it from the Salwin, which at this point is a continuous barrier rising to a height of well over 10,000 feet; its slopes are steep, but not precipitous, and are covered with pine woods. On reaching the summit of the pass we found a small post of three Chinese soldiers, from whom we learnt that the pass is open practically all the year round, as there is never very heavy snow on it. The midday temperature at that date (December 12) was 39° Fahr., and a high wind was blowing from the west. This is the pass by which Prince Henry of Orleans crossed in 1895. On the eastern side of the range the slope up from the Mekong

is a direct one, the river flowing past the foot of the main range; to westward, however, one looks out over an expanse of partially wooded mountains, the general trend of which is north and south, though at this point a stream flowing in a narrow valley cuts its way through them at right angles. The Salwin is not visible at this point, and indeed is three marches distant. The route passes through this valley, and we followed it to Lu-kou, on the left bank of the Salwin. The population of the Salwin valley in this neighbourhood is chiefly Liso, but there are also a few Minchias and Lolos near Lu-kou, as well as some Chinese or Han-jên. These different races are under t'ussu government as far north as Hsia-ku-ti (lat. 26° 16′), beyond which place there are independent tribes, possibly of Tibetan origin, who refuse allegiance to any government; these I shall have to deal with later.

The t'ussu or chiefs are of Chinese birth, and the office is an hereditary one, having originally been conferred on the family by the Chinese Government for services rendered in war time. The t'ussu rule is patriarchal, and considerable latitude is allowed them; but that the Chinese authorities retain a strong hold over the chiefs is evidenced by the fact that at the time we were at Lu-kou, the t'ussu of that place was absent in gaol, where he was just completing a term of ten years' imprisonment, which had been imposed on him by the Chinese Government for having taken the life of one of his own subjects with his own hand. A young relative was in charge of the yamen at the time; but the convict chief was released shortly afterwards, and received a hearty welcome home from the members of the clan.

The Liso, who are the predominant race hereabouts, have a distinct language, which, as far as I could discover, is not written. They are of slight build, with light-brown skin and aquiline features resembling the Red Indian type. Some of the younger men and women are distinctly pleasant featured, and are often graceful in figure and carriage. The men wear a short coat and loose knickers of blue cotton, and short loose putties which are wound round the lower part of the calf and ankle; instead of putties, gaiters of coarse hempen cloth are often worn. The men shave their foreheads at long intervals, and wear a short, unkempt pigtail, which is usually tucked up under the small puggri which both sexes wear. Every man and boy is armed, and they rarely travel beyond the limits of their villages without weapons. These are a crossbow, with which poisoned arrows are used; a long, traight, two-edged sword; and usually a small dagger or clasp-knife. e women wear a long tunic and trousers of blue cotton, with often ad horizontal band of red, white, and black round the sleeve at ow. They also affect many ornaments of silver or beads and h, as earrings and necklaces; wealthy men also often wear a ring in one ear.

Their houses are built of wood, and are either thatched with grass or pine shingles, or else roofed with large flexible mats of split bamboo, which are 6 or 7 feet wide, and long enough to reach from the eaves on one side to those on the other, so that two or three are sufficient to roof the whole house. The floor is of planks roughly shaped with an axe, and is raised some 4 to 5 feet above the ground on posts, the space underneath being fenced in and used as a cattle-shed or pig-stye. In this mountainous region villages are often built on a steep slope, the space under the floor then being triangular in section, one edge of the floor almost touching the ground, whilst the other is 5 or 6 feet

LISSU VILLAGE OF TSA-MI-TI, IN THE SALWIN BASIN. THE SCAFFOLD-LIKE ERECTION NEAR THE HOUSE IN THE FOREGROUND IS A FRAME FOR DRYING TOBACCO LEAVES. CULTIVATED FIELDS SURROUND THE HOUSES.

above it. In the centre of the floor there is a square hearth of mud, plaster, or stone let into a wooden frame, and on this the fire is kindled, the smoke finding its way out as best it may. The walls are of pine logs or else of bamboo matting, there are no windows, and the door is a rough construction of planks tied on with cane. No metal is used in the construction of the houses. The furniture consists of a few wooden blocks, or sometimes bamboo stools, for squatting on round the fire; a bed made of loose planks supported by a couple of logs; and occasionally a few roughly made cabinets or boxes entirely of wood, in which food is stored. Their utensils are an iron bowl or copper pot—the latter imported from T'êng-yüeh-ting and Yung-ch'ang Fu—and an iron tripod.

Pitchers of bamboo are used for drawing water and for storing honey and rice, etc. The Lisos are hunters, but the country has been largely denuded of game, and they live chiefly by agriculture. They have cows and pigs and goats, and, very rarely, a few ponies are also to be seen. In character the Lisos are reported to be fierce and warlike, but though this is true when they are in their own territory and in strong numbers, my experience is that they are timid and nervous among strange surroundings, and lacking in what we call pluck. On the other hand, they are courteous and hospitable, and have something of the Chinese respect for rank and authority.

During our passage through the Liso country, we noticed a considerable trade in a species of herb, called Lu-tze by the natives, which grows in the patches of jungle found low down in the valleys. The plant is a creeper, and grows on the trunks of large trees much like ivy does; its stem is thick and strong, and its leaves, which grow thickly all the way up the stem, are pear-shaped, and resemble the leaf which the natives of India use for wrapping betel-nut in (called "pan"). It has no fruit except a sort of bulbous pod, half berry and half leaf, which constitutes the valuable part of the plant. This usually grows high up on the trees, which the Lisos climb by driving wooden pegs into the trunk at intervals so as to form foot-rests. The herb has a pungent aromatic taste like a mixture of ginger and orange-peel, and is highly esteemed as a stomachic. As already stated, there is quite a large trade in this article, and we met Chinese merchants who were buying all they could get hold of. It sells from ten to twelve tael cents (3*d.* or 4*d.*) per pound.

At Lu-kou I took careful measurements of the Salwin, and found it to be of the dimensions shown in the cross-section (see map) which gives an approximate discharge of 23,000 cubic feet per second. The water was clear and of a beautiful blue-green colour; the banks are strewn with huge boulders, chiefly of granite, and there are occasional strips of silver-grey sand, evidently of granitic formation; the bed of the river is rocky, and there are frequent rapids. The river is evidently liable to a great rise at certain seasons, as its banks showed a water-mark fully 15 feet above water-level, and grass and sticks and other *débris* were hanging in the branches of trees on the banks high above our heads.

From Lu-kou there are two river-routes, one on either bank. That on the left bank had been followed by Prince Henry of Orleans during his brief excursion to the Salwin in 1895, whilst that on the right bank was said to have been used by Mr. Litton, of the extent of whose explorations in this district I have not yet seen any account. I chose the right bank, and started from Lu-kou on December 16. The Salwin valley has long been notorious for the extraordinarily precipitous and rugged character of its mountains and for its deadly climate. The bed of

the river, as is well known, lies at an extremely low level relatively to the surrounding country, and I found that at a point a few miles north of Lu-kou it was only about 3000 feet. The mountains on either side rise to heights varying from 10,000 to perhaps 15,000 feet, and their slopes are extraordinarily steep and precipitous. At rare intervals there are small patches of flat land in the folds at the foot of the slopes, but, generally speaking, the slopes descend straight to the water's edge, except where they are sheered off as it were into vertical cliffs of rock. Even to walk on these slopes without artificial means of support is often extremely difficult, and the only means of communication are narrow footpaths which wind up and down and in and out of the deeply indented hillsides. These paths are usually high above the

LISSUS IN FIGHTING DRESS. A SHIELD OF SKIN IS WORN ON THE BACK, AND THEIR CROSS-BOWS ARE ON THEIR SHOULDERS, BUT THEY ARE NOT WEARING THEIR SWORDS AND SATCHELS. THESE MEN WERE DRESSED FOR THE OCCASION, AND ARE NOT FULLY EQUIPPED AS THEY WOULD BE IF GOING ON AN EXPEDITION.

river, but sometimes they descend into its bed, when the unfortunate traveller has to drag himself over immense boulders, and rocks of all sizes from a few tens to several thousands of cubic feet, and where he must sometimes crawl along the face of a vertical cliff literally hanging on by fingers and toes, or has sometimes to climb a precipitous wall of rock, where loads, etc., have to be raised or lowered by ropes; or, again, has to cross a steep smooth slope of bare rock where a slip would send him to certain destruction in the boiling torrent below. The hillsides are chiefly covered with grass or brushwood, having been largely denuded of forest, but numerous patches remain, and one encounters widely different types of vegetation as one ascends the mountains, the lower levels presenting all the features of semi-tropical jungles, whilst pine and oak and other hardy trees are found on the upper slopes.

The deadly character which the Chinese attribute to the climate of the Salwin valley is well known, and many travellers have alluded to the superstitions that this has given rise to, notably Mr. Colborne Baber, who gives a striking account of the Salwin valley in his 'Notes on the Route of Mr. Grosvenor's Mission,' where he says, "we then discovered the strange fact that this valley is uninhabitable during the summer months on account of the malaria, the natives retiring as soon as the fields are planted, and returning to reap them in the autumn." This must apply to the particular district he travelled in (lat. 25° 0′), as, in spite of repeated inquiries, I failed to find any local belief in these deadly attributes, whilst there was no evidence of any abnormal sickness or mortality in this region. Our visit was made during the winter season when the weather was cool and pleasant as a rule, the mean day temperature during the five weeks we spent there averaging only 51° Fahr. The temperature, of course, varied considerably with the altitude, and the natives admitted that the low-lying villages suffered much from malaria, probably on account of the stagnation of air in the deep land-locked valleys, and the semi-tropical vegetation found there; similar statements, however, had been made to us at many places in Yunnan, and quinine was always in great demand.

The rugged and mountainous character of this part of the Salwin valley, and the evil reputation its climate has been said to possess, are not suggestive of a populous region, yet one of its striking features is the comparative density of the population which finds a living there. Almost every valley contains one or more villages, and the hillsides, steep though they be, are dotted with villages, which are built at all elevations right up to the snow-line, on the tops of spurs, or wherever the formation affords a sufficiently gentle slope to admit of buildings being erected and land cultivated. These villages are practically self-contained, and there is little or no trade between them. There are no markets and no shops, every family providing for its own wants by the labours of its members. The soil is a fertile one, but, owing to the steepness of the land, only limited areas are brought under cultivation. Some rice is grown in the Liso country, but this grain is almost unprocurable further north. No cotton is grown, cotton goods being imported from T'êng-yüeh Ting and Yung-ch'ang Fu, but a coarse undyed hempen cloth is manufactured locally by the women.

Travelling northwards from Lu-kou, the difficulties of the route continually increased, and our rate of advance was proportionately slow, a whole day's hard work often resulting in a net advance of only 4 or 5 miles. It was not many days before it became impossible even for unladen animals to accompany us, and I had to dispose of the two donkeys, whilst the number of coolies was increased to fourteen in order to lighten individual loads. On our way north we passed through Cheng-ka, recently the scene of tribal warfare.

A little beyond Tsao-ku-ti we left the Liso country and entered that of the independent tribes, who at this point are called Ulu Lamas. The change of type was sudden and complete, the dividing-line between the territory of the two tribes being a steep and lofty spur from the main range. The Ulu Lamas are a tribe possibly of Tibetan origin, as the name Lama implies, Lama Ti (*i.e.* the ground or territory of the Lamas) being

VIEW OF THE SALWIN VALLEY, LOOKING NORTH, IN THE ULU-LAMA COUNTRY. THE ROCK-STREWN GROUND IN THE FOREGROUND IS THAT OVER WHICH WE HAD TO TRAVEL FOR THREE WHOLE DAYS.

the Chinese name for Tibet; they inhabit the Salwin valley north of lat. 26° 19′, and are quite independent. They have no form of government, not even village headmen or chiefs. They are lawless and treacherous, and it would seem that life is held but cheaply among them; we were frequently shown the ruins of a house or hamlet and informed that the former occupants had been slain in some quarrel. They are armed in the same way as the Lisos, and, like them, are particular to carry their weapons wherever they go. In appearance

they are quite distinct from the Lisos. They are short but sturdily built, and their features are heavy and brutal in appearance; they are excessively dirty, their skin being coated with grime, and their whole appearance being suggestive of an absolute ignorance of the cleansing power of water. They wear their hair long, in shaggy locks, with a miniature queue which is usually hidden under a skull cap or turban. They told us that they shave the forehead in Chinese fashion once a year, an operation which they described as a very painful one. The men's dress consists of short knickers and a long gown or tunic of homespun hempen cloth, usually in a ragged condition. Their heads, as already mentioned, are covered with either a turban or a close-fitting skull cap, and they wear a band of split cane round the leg just below the knee. The women wear petticoats and a short coat, and are fond of wearing bead necklaces, silver earrings, etc. Clothing is scarce and in great request; we were continually pestered with requests for presents of clothes. The tribe supports itself by hunting and agriculture, but the latter is carried on in the most haphazard and wasteful fashion. There is but little rice grown, and the staple diet is Indian corn. Their language appears to be closely akin to the Liso, but is not identical. They have no written language, but transmit messages, etc., by notches on a piece of wood. They are inhospitable to strangers, very few of whom ever enter their country, and they have a deeply rooted objection to work. The women do all the household work, besides drawing water and bringing in firewood, etc. Their country contains iron and silver, both of which we saw being worked, and we heard rumours of gold. In common with the Lisos, they bury their dead, and have an aversion to either burning or dismembering the corpse. They bury them in their gardens or anywhere adjoining their houses, the grave being marked by a wooden frame, from which are suspended the weapons of the deceased in the case of a man, or a cooking-pot and "housewife" in the case of a woman. They also make offerings of food and clothing, etc., to the dead.

It was on December 23 that we entered the territory of these wild people, and a week later, after a series of severe and toilsome marches over the rock-strewn banks of the Salwin, we reached Lan-chia-ti, in lat. 26° 29′ N., where we were obliged to halt in order to collect supplies. My transport at this time consisted of fourteen coolies, eight of whom were Lisos. The latter had shown evident signs of panic ever since leaving their own country, and on halting at Lan-chia-ti they took the opportunity to desert in a body by night, leaving us with only six Chinese coolies to carry fourteen loads. The attitude of the Ulu Lamas had so far been outwardly friendly, if not over-civil. It was a festive season, December 27 being their New Year's Day, and they were celebrating the occasion with feasting and much drinking. They brought small presents to me, such as a lump of salt, a couple of

eggs, or a slice of pork—things of little value, but significant of good will. As soon, however, as they found we were left stranded by our coolies their attitude changed; they refused to supply either food or transport, in spite of liberal offers of silver, and they showed by their manner that they quite understood the fix we were in. After abandoning everything we could spare, we made several attempts over the most trying country to cross into the Irawadi basin. To my intense chagrin we were forced to return to the Salwin by the cowardice of the coolies, who absolutely refused to go on. We now returned still further south to Lu-ch'ang, from which place there is a regular trade route across a comparatively low pass, which is open practically all the year round. Here we crossed without difficulty, the snow being only knee-deep, and on January 21 we entered the basin of the Irawadi.

The change, both in the physical characteristics of the country and the type of its inhabitants, is most striking: on the eastern side of the pass one is in China, on the west one finds one's self in what may be described as an extension of Burma, and when the question of frontier delimitation has to be decided in this locality, there is no doubt that the mountains of the Salwin-Irawadi divide ought to be accepted as the political, as they are the geographical and ethnological, boundary of China.

Our route from the Lu-ch'ang pass entered the valley of the Hsiao Chiang (small river), as the Chinese call the small river which is marked on the map as the Ngaw-chang Hka, and we found ourselves in a country which, though mountainous, was obviously of a much lower average level than the district we had just left. No flat land was visible, the mountains seemed jumbled in picturesque confusion, and were covered in heavy jungle, in which bamboos, and plantains, and orchids, and other of the smaller forms of tropical vegetation mingled with gigantic trees of different kinds, whilst monkeys and parrots and other of the tropical fauna were frequently met with. Behind us the snow-clad range we had just crossed stood up like an enormous wall, shutting out the eastern horizon and towering above the less-imposing heights we were now in the midst of. The Lu-ch'ang pass is the outlet of a recognized trade route between Lu-kou and T'êng-yüeh T'ing, and we were informed that Mr. Litton had more than once travelled this way. The Têng-yüeh T'ing road turns south from a point a little beyond Tawng-gaw, west of which the communications are—except in the immediate vicinity of the villages—mere tracks through the jungle. Travelling due west, we followed the course of the Hsiao Chiang for several days, crossing it more than once by the ingenious bridges in use here. These bridges are much superior to the single-rope bridges of the Salwin; they are made of canes and creepers—one rope forming the footway, and two others the handrails, with a network of smaller canes connecting them.

The inhabitants of the region we now passed through are of two distinct types, called by the Chinese Tsa-shan-jên and Langsu-jên respectively. The former inhabit the head of the valley of the Hsiao Chiang, and at this point are said to be under the government of the T'ussu of Tengan on the Salwin, though it was admitted that the government was more in name than in fact. They have a distinct language or dialect of their own, but many of them speak Chinese. Their appearance is ugly, dirty, and forbidding, and they are classed by the Chinese as Yi-jên, or wild men. They dress much like the Lisos, with knickers, cloth gaiters, and shell-embroidered shoulder-belt and satchel, but do not use the crossbow, being armed with the Burmese "dha," or short sword, or occasionally with a spear. They neither shave the head nor wear the queue, but tie their hair into a loose top-knot which is bound round with a puggri. The men pierce the lobe of the ear and insert bamboo tubes, etc.; whilst the women, who wear voluminous petticoats, indulge in numerous large earrings of brass wire which are about 4 inches in diameter.

The Langsus are more akin to the Kachins or Singphos of North Burma; they inhabit the basin of the Nmai Hka or Langsu-ta Chiang (called also Puma Chiang or Puma Hka, *i.e.* the Puma or Burma river). The men wear the Burmese waistcloth and a short coat of Chinese pattern, and are armed with the dha; their hair is usually cut short at the neck. The women wear a short coat and a cotton cloth of many colours wrapped round the breast, and, like the Tsa-shan women, indulge in many necklaces and earrings of portentous size. In common with the Tsa-shan-jên, both sexes chew betel, and they exhibited an extraordinary craving for opium. One of our party had a little opium, tiny pellets of which he bartered for food, etc., and it was evident that had we possessed a stock of the drug, we could have lived for next to nothing, and should have met with a hearty welcome as traders. I was taken for an opium merchant, and our baggage was supposed to be full of that commodity; wherever we went the villagers pestered us for opium, and would pursue us for miles in vain attempts to obtain it. Silver was of little purchasing power, and we had the greatest difficulty in obtaining supplies, our presence being regarded with more fear and suspicion than cordiality.

The type of house which these people dwell in is one which, with very slight variations, extends throughout the Kachin or Singpho country right through into Assam. They are long, low, one-storied buildings, and are often occupied by several families, presumably of the same stock or clan, the interior being partitioned off into numerous recesses, besides having two or more cubicles. The framework is of timber, and the floor is raised some 4 feet above the ground, access being obtained by a sloping log with notches cut in it. The walls are of bamboo, and are only 3 or 4 feet high; the roof, which is of bamboo

thatched with grass or palm leaves, being very high pitched, and the eaves descending to floor-level. There are no windows, but small doors are cut at intervals in the low walls, which, when open, admit a very limited amount of light. At each end the roof is prolonged over a space which is fenced in and serves both as a cattle-pen and as a place for husking rice, weaving cloth, or other household occupations. The gables project beyond this space, and the roof is undercut so that the peak of the gable extends far in front of the eaves. The post which

ULU-LAMA WOMAN SPINNING YARN AT THE DOOR OF HER HOUSE, SALWIN VALLEY.

supports the gable at the front of the house is decorated with the horns of buffalo and oxen, the number of which is an indication of the prosperity or wealth of the residents. The floor is of bamboo-mat, with a hearth of mud plaster to each compartment, the smoke of the fires finding an exit as best it may through the doors.

That part of the basin of the Nmai Hka which we passed through may be described as rich and fertile in spite of its mountainous character. We saw tea, indigo, cotton, tobacco, oilseed, and other useful plants,

the foregoing varieties often growing simultaneously in the small patches of cultivated land adjoining the villages. Rice is also grown wherever the ground admits of it. The tea plant is indigenous to the district, growing wild in the jungle, and is not of the Chinese variety, but of a similar type to the Manipuri or indigenous plants of Assam. The leaf is manufactured by the inhabitants on a small scale by drying it in the sun, after which it is packed into bamboo tubes. The climate of this region was hot, close, and oppressive, and we suffered from attacks of malaria. A very poisonous variety of jungle fly also caused us much trouble, and doubtless was largely responsible for the malaria. This fly, which resembles a small house fly in shape and size, is striped like the anophele mosquito. It inserts its proboscis into the skin and draws blood; the bite does not hurt at the time, but several hours afterwards the wound swells and becomes painful, and the irritation continues for several days, accompanied by a watery discharge.

After following the course of the Hsiao Chiang till it turned northwards, we crossed the range which divides it from the Nmai Hka, whose tributary it is, at a height of about 7200 feet, and reached the banks of the latter river on January 28, when the measurements were taken which are shown in the cross-section (see Appendix A). These measurements give an approximate discharge of 28,000 cubic feet per second, *i.e.* more than 20 per cent. larger than that of the Salwin, and more than double that of its sister stream, the Mali Hka. The water of the river is of a different hue to that of the Salwin, being a dark olive-green; it is clear and free from silt. The bed of the river is strewn with rocks of granite and quartz, etc., and there are rapids which obstruct navigation. The banks of the river show that it is liable to a considerable rise in flood-time. The valley through which the river flows is at this point of peculiar section. The lower slopes are extremely steep, but at a height of several hundred feet above the water they are comparatively gentle; the formation suggests that the river has cut its way down into its present narrow channel through what was originally a broad and comparatively shallow valley.

After crossing the river, we ascended the range which separated it from the Mali Hka or western branch of the Irawadi. The range is a comparatively low one, being only about 6000 feet where we crossed it; its summit is broad and undulating, and, though thickly covered in heavy jungle, there is a fairly good path from Laung-pam on the east to Ning-ki on the west. After crossing the watershed, we turned north-west and shaped a direct course for the Mali Hka. The country we thus entered is in many respects quite different to that we had recently passed through. To south and east are mountain ranges, but to the north and west the country opens out, disclosing a wide view of low hills and undulating slopes. This district is a populous and fertile one, and is well watered by numerous streams, whose placid

waters and sandy beds bear little resemblance to those of the rocky torrential tributaries of the Salwin, the Mekong, and the Nmai Hka. There are numerous large villages whose inhabitants are evidently prosperous and in a far higher stage of civilization than the wild tribes of the Chinese frontier. The land is chiefly covered in thick forest, but large areas adjoining the villages are under cultivation; quantities of rice are grown, as well as sweet potatoes and other vegetables, and we saw magnificent rubber trees, enormous banians, and, in fact, practically all the luxuriant vegetation of the jungles of Assam. Good roads have been made between the villages, and the one by which we

RIVER NMAI HKA: OUR PARTY CROSSING IN A "DUG-OUT" CANOE.

travelled was evidently a main route, and, though of course not metalled, was well kept and properly graded and drained, and we were now able to push on rapidly. No animal transport is used in this country, and there is no large transit trade, the villages being almost entirely self-supporting and independent of imported goods.

The inhabitants of this region, which extends northwards as far as the boundaries of the Hkamti Long district, call themselves Pu-ma (*i.e.* Burma) men, but are in appearance, dress, and customs, etc., identical with the Singphos of the Assam frontier. We were, of course, unable to converse with these people, but the few words of their language which we did acquire served us equally well among the

Singphos, and I believe that their language is the same. They are brown-skinned, of medium height, and slight build, with features of the Burmese type. The men wear a straight waistcloth or kilt, and a short coat; their hair is either cut short at the neck or worn in a topknot, and they wear a broad-brimmed palm-leaf hat with a small conical crown. They are armed with the "dha," but occasionally carry spears as well, and we noticed a few flint-lock tower muskets, one of which I observed was dated G.R. 1815. The women wear a coloured cotton cloth similar to the Indian "sari," which they wind round them so as to form a dress. Their breasts are bound tightly down by the cloth after the fashion of the Manipuri women; but, like other natives of hot climates, they are very free and easy in their dress, and display their bosoms freely, often removing the cloth altogether above the waist. The clothing of both sexes is of local manufacture, cotton weaving being one of the most important of the feminine duties. Women take a large and active part in the maintenance of the household; they spin yarn, weave cloth, cut grass for thatching purposes, husk rice, and superintend the poultry yard, besides performing many of the lighter duties of the cultivator, such as reaping and weeding, etc.

The houses of these people are similar to those of the Langsus, and, as with that tribe, each village has a headman or chief whose house is usually distinguished for its superior size, and the number of buffalo-horns with which its portals are decorated, and by an arrangement of logs a short distance in front of it somewhat like the letter W. Again, similarly to the Langsus, they burn their dead, the ashes of the corpse being placed in an oblong wooden box, shaped roughly like a mummy and approximately the size of the dead person's body. This box is supported above the ground on bamboo trestles, and is sheltered from the elements by a roof of a more or less elaborate character according to the position the deceased held; thus the remains of ordinary individuals are merely roofed over by a small shed, whilst those of the headmen and their families are placed inside large dome-shaped erections of bamboos, thatched with palm leaves, and provided with a door through which the mourners can enter. The summit of the dome is decorated with a pair of buffalo-horns, or imitation ones of wood. A small bamboo pedestal is erected by the side of the bier, and on this various offerings of food, etc., are placed, whilst the urn itself is often wrapped in a blanket or other clothing as a protection against cold.

The reception we met with from these people was not altogether unfriendly, but they exhibited an extraordinary objection to selling us provisions, etc., and we often came near to a serious fracas in our attempts to procure the necessaries of life. Their diet consists chiefly of rice, but they have poultry and eggs, fish, pork, etc., though they almost invariably denied the existence of these articles, or produced

them in such minute quantities as to be useless to us, whilst demanding exorbitant prices; consequently we had to exist largely on rice during our passage through their country. They are not a trading people, and they had no wish to deal with us, whilst they undoubtedly looked on us with suspicion and fear. Here, as amongst the Langsus, there is a great demand for opium, and I have no doubt that one reason we passed without molestation was because of our reputed character of opium dealers bound for Hkamti. In connection with this, it is interesting to note that the Chinese appear to have traded throughout this country, even as far as the Hkamti Long district. We were told that this was

VILLAGE SCENE IN THE VALLEY OF THE NMAI HKA. HOUSE AND NATIVES ARE LANGSU OR SHANS. THE MAN WITH THE GUN IS ONE OF MY CHINESE SERVANTS.

the case, and occasionally we came across men who knew one or two Chinese words; the Chinese mode of address "Lao-ban" was often applied to my servants, who were spoken of as Kuang-tung men (*i.e.* Cantonese).

The climate of this region in January and February was warm and moist; the daily mean temperature was only about 55° Fahr., but the humidity made the air very oppressive, and there were frequent thunderstorms.

We came in sight of the Mali Hka on the morning of February 2, when we noticed a phenomenon which appears to be of frequent occurrence in this district. Our route was at a considerable elevation above the valley of the river, and we looked out over a vast sea of

dense milk-white mist, which completely screened the river and the low-lying ground before us, only the tops of the hills protruding above it like islands. Far away to north and west stretched a high wall of snow-clad mountains—those of the Patkoi and Namkiu ranges—forming a huge semicircle, as it were, which barred the way to India and Tibet; above the mist all was clear and bright, and the snowy barriers on the horizon glittered in the morning sun, whilst below us all was hid from view by the mist. It was a striking and curious sight. About 11 a.m. the mist slowly rolled away, and we now enjoyed a spacious view of the valleys before us. These morning mists are of dense white vapour saturated with moisture, which falls pattering on the leaves of the trees like drops of heavy rain. They are probably of a malarious character, and some of our party suffered from that malady during our stay in this region. Similar mists are common in Assam during the cold weather, and I noticed a like phenomenon in some of the valleys of the Singpho country on the borders of that province.

The Mali Hka is very different in character to its sister stream, the Nmai Hka. It is comparatively shallow, its maximum depth being only 20 feet, and it is much broader, whilst its current is less swift, and its discharge is only some 13,000 cubic feet per second, or less than half that of the Nmai Hka. Unlike the Nmai Hka, which is confined by steep and rocky banks, it flows between low banks of earth, which are covered in dense jungle; its waters are clear and of a dark olive-green hue, and they abound with fish. There are rocks and rapids which prevent navigation, but its bed at this point (lat. 26° 21′) is chiefly of sand and clay. The river is apparently not subject to any great rise in flood-time, its high-water mark being only some 5 feet above the water-level.

Beyond the Mali Hka we turned northwards, following what is a main trade route from British Burma to the Hkamti Long district. The jungle now became thicker, and clearings less frequent, whilst roads only existed in the immediate vicinity of villages, the route otherwise being a mere jungle path which often lost itself in streams whose course it followed. At length, some ten days later, after marching for two days through an uninhabited belt of jungle, we emerged at Intaw, in the Hkamti district, and a day's march further we reached the town of Langnu, from which point I had determined to attempt the passage of the Chaukan pass.

We now found ourselves in a country which, though in most respects similar to that we had just passed through, is populated by a distinct tribe or race who boast of a king, whose capital at Putau is also called Hkamti. We were now on comparatively well-known ground, the kingdom of Hkamti having been explored by a survey party from India in 1895, under Woodthorpe and Macgregor, of whom we found traces in Langnu, by Errol Gray in 1892, and by Prince Henry of Orleans in 1896.

Langnu is a town, or rather a collection of four villages, on the right bank of the Nam Kiu, a tributary of the Mali Hka, and is the head-quarters of the "Chowpa," or headman of the surrounding district. On arrival there we were received in a most cordial fashion; we were invited to stay in the "Chowpa's" house, and were furnished with ample supplies. As soon, however, as it leaked out that we were bound for India, all sorts of difficulties were put in our way, and neither guides nor coolies were forthcoming. The maps which I possessed showed two villages on the Hkamti side of the Chaukan pass, and the Hkamtis furnished me with the names of ten stages on the route, which seemed to imply that it was inhabited. Accordingly, after spending a day in fruitless efforts to obtain transport, we started

HOUSE OF THE HEADMAN OR "CHOWPA" OF LANGNU, IN THE HKAMTI DISTRICT.

for the pass without guides, carrying a supply of rice sufficient for a week.

A few miles from Langnu the route entered an enormous tract of jungle, which extends without interruption from this point, across the Namkiu and Patkoi mountains far down the valley of the Dihing river, with only a solitary break near Kumki. We marched westwards, groping our way through dense, gloomy, and uninhabited forest, where we followed the tracks of rhinoceros, elephant, buffalo, tiger, and other wild beasts, and where our only guides were the compass and the faint trail or "blaze" with which the trees were marked at intervals. It rained the whole time, and we were attacked by incredible quantities of leeches and poisonous insects. At night we camped, or built ourselves shelters of bamboo, and kept fires alight to ward off the wild beasts. After five days we failed to see any signs of the villages marked on the map, whilst the stages mentioned by the Hkamtis proved to be the

sites of long-extinct villages, now distinguishable only by the remains of graveyards deeply buried in the forest, which showed no signs of ancient clearings or cultivation. Food was now running short, and it became necessary to give up the attempt. We returned by forced marches and on very short rations, and with difficulty succeeded in regaining Langnu just as our supplies gave out.

The coolies were so exhausted and footsore after this experience that we had to halt for a week at Langnu. Provisions were collected, and, by means of the bribe of a gun, guides were obtained, and on March 2 we set out on a second attempt to cross the Chaukan. Again we entered the jungle, but after another period of wandering the guides proved incapable and unable to find the route over the passes, so that, in spite of having ample supplies, we were at length obliged to return once more. This time, however, we did not reach Langnu, as before emerging from the jungle we encountered a party of Hkamtis who were setting out on a journey to Assam to bring back an elephant for one of the local headmen, and, after some palaver, we arranged to attach ourselves to their party and travel in company. Some of the coolies were too weak to go on, and we had to allow them to return to Langnu, which meant that their loads had to be thrown away, as we were already laden to the utmost.

This third attempt proved successful, and at length, on March 15, we crossed the watershed of the Dihing and entered what is, geographically speaking, Assam. We found that the villages of Mokoshat and Galut no longer exist, though we camped on their sites, and that the route over the Chaukan pass is now disused in favour of one which crosses the neighbouring height of the Songsan Bum, which, though somewhat longer, is said to be easier. We followed the disused route, and had to frequently cut our way through the thickly growing bamboos and fallen trees, etc., so that our progress was necessarily very slow, especially as the natives themselves had the greatest difficulty in finding the track, and frequently lost their way. Altogether we were nineteen days from the time we left Langnu on our second venture until reaching the first village on the western side of the pass, and during most of that time we had to travel on short rations, whilst the rain fell almost continually. Frequently there were heavy thunderstorms, and on the heights we experienced hail, and sometimes even snow.

Our companions, the Hkamtis, travelled in the most leisurely fashion, and observed several curious customs, some of which were doubtless based on practical experience as well as on superstition. Thus they prohibited us from burning bamboos until they had been split or notched, so as to allow the air and water to escape, as the loud reports which they would otherwise make were said to be infallible rain-producers—an idea which, considering we were among the clouds, and in an extremely rainy locality, was probably not devoid of reason.

They also forbade us to speak above a whisper on the mountains, as they said that if we made a noise we should certainly have rain. Later on, however, when we had descended to lower levels, these prohibitions were withdrawn. On the summits of mountains, or after specially difficult undertakings, such as the passage of rivers, etc., prayers and offerings were made, the latter being placed on small bamboo pedestals, and consisting of a little rice or some leaves or grass.

The long sojourn in the jungle and continued short commons told severely on our Liso coolies, who became terribly weak and sickly and dispirited, and it was a great relief when we at length emerged suddenly from the forest and found ourselves in a long grass-grown valley, with low hills to the south, and a lofty range of snow-clad mountains to

RIVER SCENE NEAR LANGNU, IN THE HKAMTI DISTRICT.

north of us. The route now followed the banks, and often the bed, of the Dihing, and we soon reached Kumki. Kumki is a village of some 200 to 300 inhabitants on the left bank of the Dihing; its inhabitants are Singphos, a tribe which is so identical with that which I have already described as inhabiting the basin of the Mali Hka, that there is no need for further description. Our reception by them was not pleasant, and we had to use threats in order to obtain food. Five days more of jungle travelling, accompanied by the usual amount of rain and leeches, etc., brought us to the Dihing again, where, owing to the river being in flood, it was impossible to ford it, and we were thus in measurable distance of starvation, as our supplies were almost exhausted, and there were no villages on our side of the river. Fortunately, a band of Mishmis who we encountered were in the same plight, and constructed a rope bridge by which we were enabled to cross to the other bank.

The method of construction was interesting. First a thin string of split cane about $\frac{1}{8}$ inch in width was prepared, and a round pebble securely fastened to one end of it. Then the experts of the party exercised their skill in hurling it across the river. The Dihing at this point was about 100 yards across, so that the operation was not easy.

The thrower whirled the stone round and round by a sufficient length of string, and then, when it had acquired enough momentum, hurled it with all his force across the river, where it was made fast by some compatriots who had come to the assistance of the party. Then three ropes of whole cane, about $\frac{3}{4}$ inch in diameter, were hauled across by means of the string and made fast to tree-trunks on either bank, so as to form a triple rope of adequate strength. The bridge was now ready, and loops of cane were made and tied over the rope. The passenger sits in the loop, and hauls himself across backwards (*i.e.* head first) by his hands, propelling himself by his feet at the same time. When women have to cross, they are trussed on to the rope so that they cannot fall off, and then have to haul themselves across by the arms only, their feet being tied on the rope. The Mishmis crossed first, and accomplished the feat skilfully enough; but it is not easy for an amateur, especially when there is a boiling torrent some 20 feet below one, and we found it difficult and exhausting work.

Across the river our troubles were nearly over, but it was still a day's march to the first village, and between us lay the Daphapani river, where we again found ourselves cut off by the swollen stream from the food we required. Fortunately, before matters became desperate, we were relieved by a band of friendly Singphos, who provided us with food, and rafted us across the river as soon as the waters had subsided somewhat. We were now on British territory, the Daphapani being the limit of effective British rule in this direction, and from this point we descended the Dihing without difficulty, and a week later reached Sadiya, and once more came in contact with civilization.

The results of the journey I have described can only be gauged by expert geographers, and I am well aware that, in comparison with the time occupied and the distance covered, they are insignificant; nevertheless, some new areas have been explored, and the existence or practicability of a direct trade route from China to India demonstrated. The course of trade, like water, follows the line of least resistence, and our difficulties in the Salwin valley were largely due to our attempts to explore a region in which no trade exists. When following the trade route across the Pien-ma pass through the basin of the Nmai Hka, we encountered no serious difficulties, except those due to our ignorance of the language and the distrustful attitude of the natives—the latter, I believe, being largely due to the former cause, though, doubtless, also based on a well-founded fear of foreign invasion and interference. Our passage through the Singpho country and into the Hkamti district was also a main trade route, which, as already pointed out, has been used by Chinese traders as well as by the inhabitants of the country. This district is both fertile and populous, and the physical characteristics of the country render it suitable for the construction of lines of communication, such as railways and roads.

The chief obstacle on the route to India is undoubtedly the vast tract of uninhabited jungle between Hkamti and Assam; yet it is to be noted that a trade route existed here at one time, as is shown by the remains of the old villages which are to be seen on the present track, whilst even now there is a small trickle of trade (passing chiefly by the Songsan route), which might possibly be enlarged. The actual trade is of the smallest, for the reason that any one making the journey has to carry such a large stock of provisions as to preclude the possibility

THE "CHOWPA" OR HEADMAN OF LANGNU, IN THE HKAMTI DISTRICT.

of carrying much merchandise — though I found that Indian tea, blankets, and matches were known and used in Hkamti—but parties of natives are in the habit of passing through to Assam and back from time to time.

The chief difficulties of this forest track are the lack of roads and supplies, and the heavy rainfall, whilst the lofty ranges of mountains strictly limit the number of possible routes. I heard of two other routes besides the one I travelled by, viz. one over the Songsan Bum, and one through Manse and down the valley of the Daphapani river, the latter being that followed by Prince Henry of Orleans. West of Kumki the configuration of the country is not exceptionally difficult, and I believe

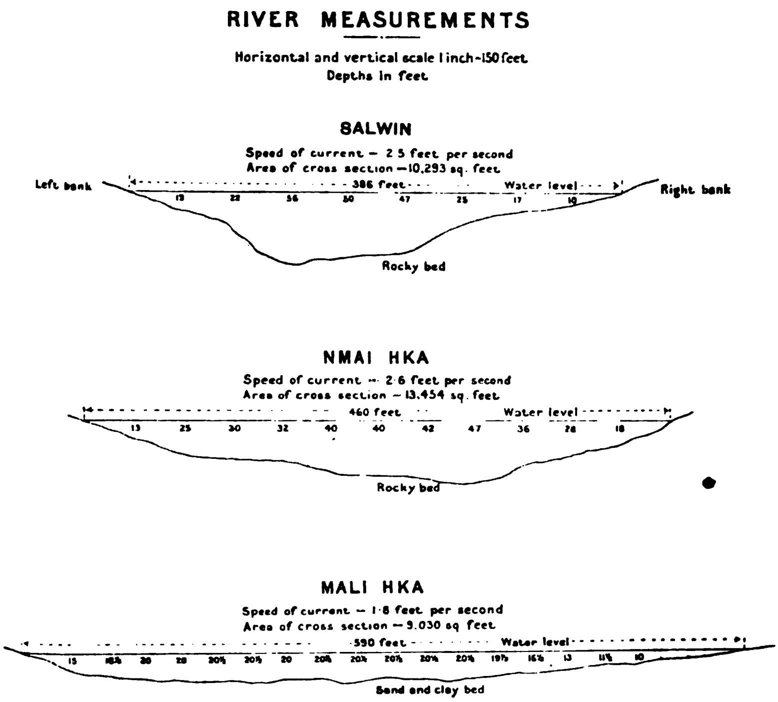
it would be quite feasible to construct a railway up to the Dihing valley to a point near Kumki, and then through the Patkoi hills, and down the valley of the Sinan Hka.

Although, as I have shown, I travelled by what is probably the easiest and most direct route from Yün-nan to Assam, yet it should not be supposed that such a journey is an easy one. As in any expedition of this kind, our chief difficulties were those of commissariat and transport, for though in China we found no difficulty in obtaining supplies and the means of carrying them, and in fact were received with cordiality and treated with respect and hospitality, yet almost everywhere west of the Salwin the reverse was the case, and, though in a land of plenty, it was often only possible to obtain food by high-handed methods which only necessity could warrant, whilst it was frequently impossible to recruit coolies for transport purposes. I, of course, paid liberally for all supplies, but more than once we had to "commandeer" rice, etc., in spite of the obviously false statements of the villagers that no kind of provisions were to be obtained.

Many of our difficulties arose from ignorance of the language, as, although I speak Chinese and Hindustani, neither of those languages were of use much beyond the frontiers of the two empires. On the other hand, I believe that it was the smallness and insignificance of my party which enabled us to travel so freely through the districts where white men had never been seen, and where his presence is regarded with the greatest suspicion. That we never encountered active hostility is creditable to the natives, and also, I think, in some degree to the various members of my party, and in conclusion I must again record the admiration I feel for the pluck and fidelity of my two Chinese servants.

APPENDIX A.

The accompanying cross-sections were all taken in the following manner: (1) The width of the river was triangulated from a measured base. (2) The soundings were taken with a measured rope, marked at every 5 feet, and weighted with a stone; the intervals between soundings being judged so as to be as equal as possible. (3) The sections were taken on a straight reach of the river not in the immediate vicinity of the rapids. (4) The speed of the current was measured with a bamboo float about 10 feet long, weighted at one end to keep it upright and immersed about 6 feet below water. This float was placed in the water from a boat or raft at the approximate point of maximum velocity, and its speed was timed between stakes on the bank 300 feet apart.



These methods are, of course, only rough and approximate, and it would therefore be useless to make very elaborate calculations of the discharge of the river. Assuming, however, that the velocity observed was the maximum, the mean velocity, as given by accepted formulæ and confirmed by local experience, would be about 0·8 of the maximum; and adopting this ratio for the Nmai Hka and Mali Hka, we get approximate discharges of 28,000 and 13,000 cubic feet per second respectively. In the case of the Salwin, the section of the bed is so narrow and deep, and the current consequently so uniform, that I have taken 0·9 as a probable ratio, which gives a discharge of 23,000 cubic feet per second.

APPENDIX B.

LATITUDES.

No.	Name of place.	Method of observation.	Latitude. ° ′ ″	Remarks.
1	Meng-tze-Hsien	Ex-meridian alts. of Polaris	23 16 1	Fair.
2	Mien-Tien	Meridian alt. of Formalhaut	23 36 55	Good.
3	Do.	Ex-meridian alts. of Polaris	23 38 12	Good.
4	Yung-lung-Cho	Meridian alt. of Sirius	25 48 9	Fair.
5	Do.	Ex-meridian alts. of Polaris	25 48 48	Fair.
6	Fei-lung-Chiao	Meridian alt. of Sun	25 47 20	Good.
7	La-ha	Ex-meridian alts. of Polaris	25 51 40	Doubtful.
8	Do.	Meridian alt. of Rigel	25 50 22	Good.
9	Lu-kou	" " "	25 50 46	Good.
10	Do.	Meridian alt. of Dubhe	25 52 35	Doubtful, sky hazy.
11	Mao-chao	Ex-meridian alts. of Polaris	26 5 8	Fair.
12	Do.	Meridian alt. of Rigel	26 2 27	Doubtful.
13	Lan-chia-ti	Meridian alt. of Sun	26 29 42	Doubtful, sky very hazy.
14	Do.	" " "	26 29 19	Good.
15	Near Meng-chao	" " "	26 2 9	Good.
16	Lao-Yang-Ka	Meridian alt. of Rigel	26 12 50	Moderate.
17	At R.Ma-li-Kha	Meridian alt. of Sun	26 21 10	Good.

The above observations were made with a 7-inch sextant (by Stanley & Co.) and a mercurial artificial horizon, times being noted by a Benson's half chronometer "Field" watch.

APPENDIX C.

LONGITUDES.

No.	Station.	Object observed.	Longitude E. ° ′ ″	Remarks.
1	Fei-lung-chiao	Sun E.	99 10 12	Observation good.
2	La-ha	Star E.	99 3 39	" "
3	Lu-Kou	Star W.	98 54 52	" "
4	Do.	Sun E.	98 55 5	" "
5	Lan-chia-ti	Sun E.	99 10 33	Observation good, but error of watch doubtful; reject.
6	Do.	Sun E.	99 3 39	Observation good, and error of watch determined approximately by calculating back from deduced rate.
7	Right bank of Ma-li-Kha in lat. 26° 21′ 10″	Sun E.	97 57 43	Observation good, but result probably too high.

The above observations were made with a 7-inch sextant (by Stanley & Co.) and a mercurial horizon. The method used was that of chronometric difference of time, G.M.T. being kept on a Benson's half chronometer "Field" watch. In the case of the sun, the mean was taken of six observations of the upper and lower limbs at ten-second intervals of arc; and in the case of stars, the mean of seven observations at ten-second intervals of arc was taken. Unfortunately, the watch proved so susceptible to changes of temperature, in spite of its being fitted with a Bréguet spring and other improvements, that its rate was erratic, and as I was not able to rate it at sufficiently short intervals, the longitudes I obtained can only be considered as roughly approximate.

THE HEART OF THE SOUTHERN ALPS, NEW ZEALAND.

By JAMES MACKINTOSH BELL, Director, Geological Survey, N.Z.

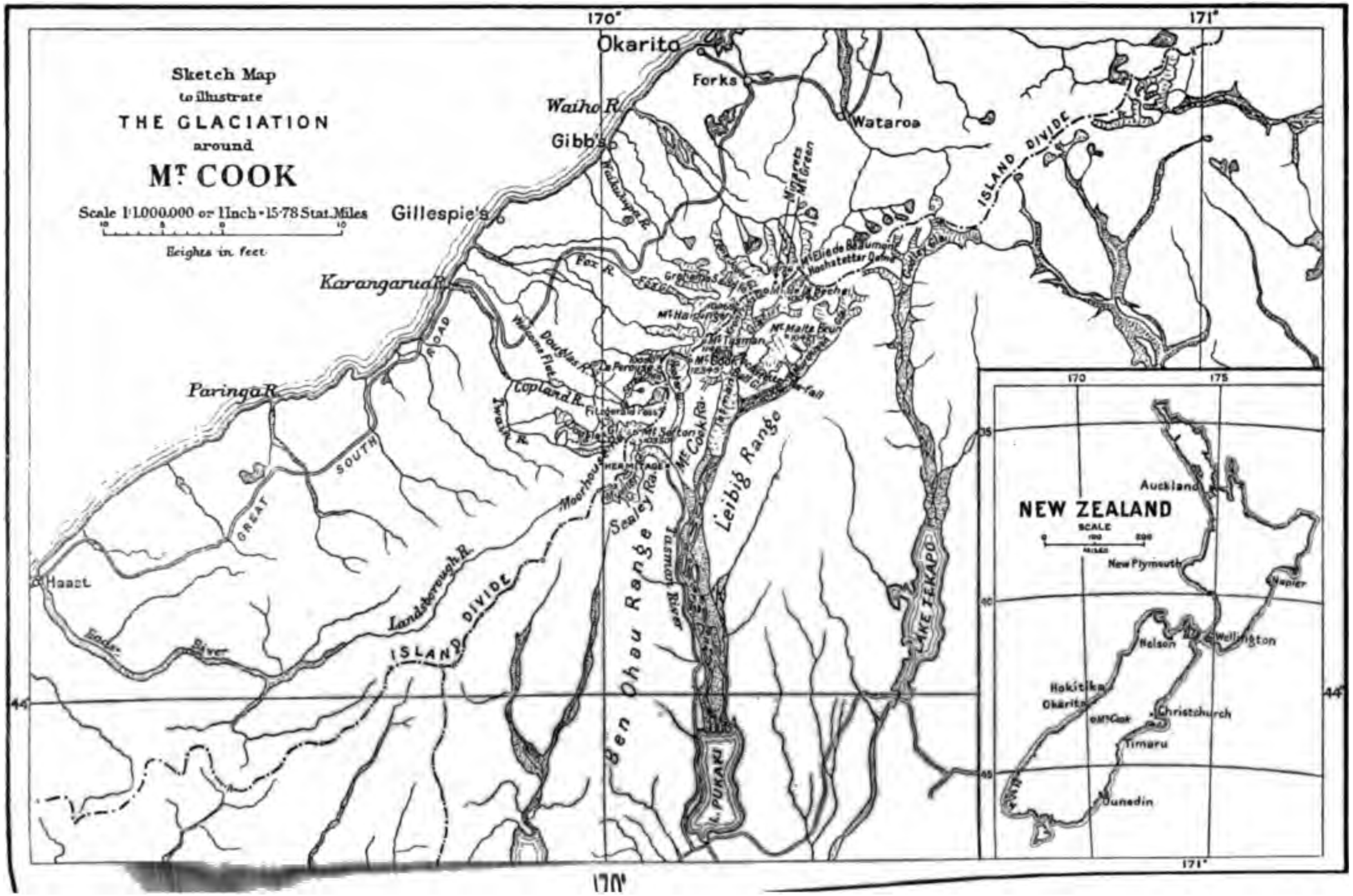
Introduction.

The central part of the Southern Alps, which includes the elevated country surrounding the magnificent peak of Mount Cook, presents many features of remarkable interest to the glaciologist and physiographer, and exhibits an area of country of rare charm to the observant alpinist and explorer. This part of the Southern Alps encloses, in addition to Mount Cook, the lofty peaks of Darwin, Malte Brun, Hochstetter Dom, Mount Elie de Beaumont, Mount de la Bêche, Mount Haidinger, Mount Lendenfeld, the Silberhorn, Mount Hector, Mount Tasman, Mount Stokes, and Mount Sefton, all over 9800 feet in height, and rising, clad in perpetual snow, amid spacious fields of *névé*, from which emanate most of the great glaciers of New Zealand. These peaks represent the highest though not the most inaccessible country in New Zealand, and all stand near the island divide. A view obtained from various points of vantage on the divide discloses to the east and west most of the salient physical features of this interesting part of the country. Towards the west is visible the rapid descent of the country towards the Tasman sea; the rugged snow-clad peaks can be seen to be, near at hand, replaced by mountains with snow only on their summits and with their lowest slopes thickly wooded. These give way farther to the westward to wooded hills free from snow which close to the sea pass abruptly into flat or rolling lowlands, covered with dense forest. Towards the east the descent of the country is also rapid, but not nearly so much so as on the western side. The mountains gradually decrease in altitude, and are finally replaced by the rolling treeless stretches of the Mackenzie and Upper Waitaki plains, surmounted by an occasional outlying mountain. The sparseness of forest on the eastern side of the Alps stands in marked contrast to the western side, and only at a few sheltered spots along the lower mountain slopes, near the river courses, are visible the groves of stunted trees.

The Great Tasman System.

Two sections across the Southern Alps—one by the Tasman river, Hooker glacier, Fitzgerald pass, and the Copland valley, and the other by the Tasman glacier, Graham's saddle, and the Franz Josef glacier—will illustrate some of the most striking features of this interesting glacial area.

The longest and widest glacier in New Zealand is the great Tasman glacier, which has a length of 18 miles from its source at the base of the Hochstetter Dom to its terminal face, and a maximum width opposite the



Sketch Map
to illustrate
THE GLACIATION
around
M^{T} COOK
Scale 1:1,000,000 or 1 Inch = 15·78 Stat. Miles
Heights in feet
170°
171°
44°
Okarito
Forks
Wataroa
Waiho R.
Gibb's
Gillespie's
Karangarua R.
Paringa R.
Haast
Fox R.
Copland R.
Douglas R.
Welcome Flat
Twain R.
Fitzgerald Pass
Mt Sefton
Mt Cook
Mt Tasman
Mt Haidinger
Mt Malte Brun
Mt Elie de Beaumont
Mt Green
Hochstetter Dome
Hermitage
Moorhouse
Mt Cook Ra.
Sealey Ra.
Leibig Range
Ben Ohau Range
Tasman River
L. Pukaki
Lake Tekapo
Landsborough R.
Island Divide
Great South Road
River
NEW ZEALAND
SCALE
Auckland
New Plymouth
Napier
Wellington
Nelson
Hokitika
Okarito
Mt Cook
Christchurch
Timaru
Dunedin
170
175

mouth of the Murchison river, later to be described, of $2\frac{1}{10}$ miles. From the terminal face of the Tasman glacier flows the river of the same name, which enters Lake Pukaki, after a course of about $23\frac{1}{2}$ miles. For this distance the stream anastomoses in many channels, through a broad U-shaped valley. The various streams are constantly changing their courses—a condition which, with the many quicksands, renders the river a very difficult one to ford. The river flat through which the various distributaries of the Tasman ramify is about 4 miles wide, on either side of which low morainic hills stretch to the base of the mountains—the broken Leibig range on the north-east, and the rugged slopes of the Ben Ohau range on the west.

THE KARANGAMA RIVER.

From 4 to 6 miles below the terminal face of the Tasman glacier the Tasman river receives the distributaries of the Hooker river—a wild turbulent stream formed by the union of the water from the Hooker and Mueller glaciers. Lake Pukaki, which has a length from north to south of 8 miles, and a width in the opposite direction of $3\frac{1}{2}$ miles, had formerly a much greater northward extension, its basin having been filled by the masses of *débris* brought down by the Tasman river. The outlet of Lake Pukaki is by the Pukaki river at its extreme south-western corner, where the river flows through thick masses of the terminal moraines deposited by the ancient Tasman glaciers. Lake Pukaki owes its origin to the damming by these moraines of the broad Tasman trough, probably formed by glacial planing along a pre-existing

river channel. Many phenomena testify to the former great extension of the Tasman glacier—the terminal and lateral moraines spreading far out on to the Mackenzie and Upper Waitaki plains; the ancient glacial terraces deposited on the slopes of the Ben Ohau and Leibig ranges, the highest of these being probably about 1500 feet above Lake Pukaki, but farther north occurring at greater altitudes; and the steep generally smooth lower slopes of the bordering ranges, especially towards the present terminal face of the Tasman glacier. The differences of level between the lateral moraines of the ancient Tasman glacier is a somewhat remarkable feature.

The Tasman Glacier Proper.

The Tasman glacier, which is longer than any single glacier in the Swiss Alps, though now vastly inferior in size to its former magnificent proportions, is still a very splendid ice-stream. In its lower reaches it is bordered by the Leibig range on the east, and by lesser peaks of the Mount Cook range on the west. Above the entrance of the Murchison the rugged snow-clad slopes of the Malte Brun range and Mount Darwin on the east, and the stately peaks of the island divide and Mount Cook on the west, surround the great glacier. From the east the most prominent entering stream is the Murchison. The terminal face of the Murchison glacier is about 1½ miles above the junction with the Tasman, and most of the water which flows from it continues down along the eastern side of the Tasman ice and enters the river just below the snout of the Tasman glacier.

The Darwin glacier flows into the Tasman from the east, between Mount Malte Brun and Mount Darwin. The largest tributary glaciers entering from the west are the Ball, Hochstetter, Haast, and Kron Prinz Rudolf, which flow from spacious snow-fields amid the mighty peaks of the island divide. These glaciers will be described later. Towards the lower part of the Tasman glacier numerous small streams of water descend in abrupt waterfalls from small U-shaped hanging valleys perched high on the mountain-sides. They flow from ice-blocks on the Leibig and Mount Cook ranges, and probably entered the Tasman glacier with an even gradient during the period of its maximum extension.

The Hochstetter Dom has a very steep descent to the Whymper glacier, at the head of the Wataroa river, which flows to the west coast, but a comparatively gradual inclination to the Tasman glacier on the eastern side of the Alps. Below the huge bergschrund, which almost completely engirdles the summit of the Hochstetter Dom, the ice of the upper part of the glacier is remarkably smooth for about 4 miles, where crevasses disposed almost at right angles to the course of the glacier first become prominent, and from here thickly seam the ice for 4 or 5 miles. In the lower part of the glacier, where the moraines completely shroud the ice, crevasses are not especially evident, though the surface of the

ice, in ridges, hummocks, and hollows, is extremely uneven. The deep blue pools and glistening walled "moulins," which are common, especially in the middle and lower parts of the Tasman glacier, are very charming features. On the western side of the Tasman glacier, for some 6 miles above its terminal face, or as far as the entrance of the Ball glacier, appears a deep boulder-strewn trough, between the lateral moraine of the present Tasman glacier and the smoothed slope of the Mount Cook range, which formerly formed the border of the glacier. At intervals along this curious trough, boulder fans enter from the slopes of the Mount Cook range. These in some places dam back small ponds of water issuing as springs from beneath the lateral moraine,

FRANZ JOSEF GLACIER, FROM THE LOWER RIDGES ON ITS SOUTHERN BORDER.

which is often 165 feet in height. Several of these situated near the terminal face of the glacier are of exquisite beauty, the water, of a rich blue colour, being surrounded by thick alpine scrub and gay alpine flowers.

The lower 5 or 6 miles of the Tasman glacier are entirely moraine-covered; the upper 3 or 4 miles are apparently almost free from moraine, and the intervening space shows an increasing amount of moraine towards the terminal face. Lithologically, the morainic material consists entirely of grauwacke and argillite, of which rocks interstratified the adjoining mountains are composed. The morainic material is of all sizes, from fine powder to blocks weighing hundreds of tons. Some of the coarsest *débris* is that brought down by the Kron Prinz Rudolf glacier. Striated pebbles and boulders are comparatively rare, the rocks being on the

whole too soft to retain the scratches well. The boulders are mostly angular or sub-angular, but occasionally are rounded by abrasion with other boulders in the englacial streams. In the distribution of the moraines on the surface of the ice, one of the best indices to the movement of the ice may be seen. The lateral moraines brought down by each tributary glacier bend in broad curves, and unite with those of the neighbouring glaciers to form the medial moraines. These, some 5 or 6 miles above the frontal face, are separated by bands of clear ice free from moraine, but nearer the frontal face unite to form the mantle of *débris* which, disposed now in ridges, now in hollows, completely covers the clear ice. The relative increase in the quantity of morainic material on the surface of the ice near the terminal face is chiefly due to the removal by melting of the ice which shrouded the *débris* higher up the glacier.

The eminent Prof. Heim, of Zurich, who visited the Tasman glacier in 1902, mentions that the bordering rocks show no evidence of striation.* This statement, though generally true, is not always correct, as the lower and middle slopes of Mount de la Bêche, composed of hard grauwacke, are exquisitely striated. The water issuing from beneath the snout of the Tasman glacier is heavily charged with rock flour, but this is apparently derived from the comminution of rock fragments within the ice by grinding against one another, rather than as a result of rock excavation. In fact, the modern Tasman glacier is merely a shrunken remnant of a former much greater feature, and it could hardly be expected to be erosive in action, when filling a trough which is more than ample to contain it, and which is apparently the product, as already mentioned, of an ancient great ice advance —in a period of "ice flood."† During this former period there can be no doubt that the glacier was erosive, as evidenced by the broad U-shaped valley in which the Tasman glacier and river now flow. In this broad valley the spurs entering from either side are truncated.

From careful surveys made by Mr. T. N. Brodrick,‡ the Tasman glacier gives no direct evidence of any decided permanent advance or retreat in recent years, though there are naturally minor changes in position depending on the condition of the snowfall. The advance and retreat is much more conspicuously shown in the case of the tributary glaciers of the Tasman. Some slight evidence of a decided advance of the Tasman within recent years is given by the partial demolition of a lateral moraine which borders the glacier on the west. This lateral

* See note, by Dr. A. Heim, p. 18, of the 'First Annual Report of the New Zealand Department of Tourist and Health Resorts.'

† See paper by E. C. Andrews, "The Ice-flood Hypothesis of the New Zealand Sound Basins," *Journal of Geology*, vol. 14, No. 1.

‡ See paper by T. N. Brodrick, district surveyor, on "Ice Motion of the Canterbury Glaciers," in the *New Zealand Alpine Journal*, October, 1894.

moraine is sufficiently old to have become fairly well covered with vegetation. During the summer of 1905—and I understand for some years previous—its eastern side has been gradually undermined. This process may simply indicate a change in the course of the glacier, but from various features seen in the field, this seems hardly probable.

The Ball glacier, which originates on the Mount Cook range near Ball pass, leading to the Hooker glacier, descends at first in a series of ice-falls, and enters the Tasman in a heavily moraine-covered train. It

WESTLAND FOREST.

is remarkable chiefly from the fact that its course is at an angle of about 315° with that of the main glacier. Perhaps there is no finer sight within the limits of the area covered by the Southern Alps than the great Hochstetter ice-fall. This magnificent glacial feature descends nearly 4000 feet, in a great cascade of ice almost three-quarters of a mile in width. The *séracs* of splendid proportions rise in places almost 100 feet in height, separated by yawning crevasses of profound depths. The Hochstetter glacier starts at the edge of the great ice plateau, which is a mile

long by three-quarters of a mile wide, lying at the base of the Linda glacier descending from the slopes of Mount Cook. The Haast glacier, which descends from the *névé* surrounding the mountain of the same name, also exhibits a series of imposing ice-falls. The Kron Prinz Rudolf glacier, originating in the snow-fields around Graham's Saddle, carries much moraine to the main ice-stream. The view obtained from Graham's Saddle, which leads from the Tasman to the great Franz Josef glacier on the Westland side, is one of the best to be had anywhere in the Southern Alps. To the southward, the broad U-shaped strike valley of the Tasman, bordered by lofty glacier-dotted mountains on either side, can be traced for miles; while to the westward the magnificent Franz Josef glacier can be seen to be flowing just below Graham's Saddle, and to descend abruptly between the rugged snow-clad ridges down into the luxuriant verdant forest of Westland, bordering on the Tasman sea, which glimmers in the distance. All around is seen a veritable *mer des montagnes*, the giant peaks of de la Bêche, Haidinger, Haast, and Hector being especially evident, with ever prominent the stately monolith of Mount Cook.

Graham's Saddle is comparatively easily reached from the Tasman glacier. The route passes up the Kron Prinz Rudolf glacier to the base of the ice-fall; then, after traversing a rather serious bergschrund, ascends a long steep couloir on to a steep *arête* leading to Mount de la Bêche. This *arête* is ascended for some hundreds of feet, when a descent is made to a deeply crevassed snow-slope of gradual inclination leading to the elevated col.

The Mueller Glacier.

The Mueller glacier is of a most extraordinarily crooked shape. Near its source it flows almost north-east, while in its lowest reaches its course is to the south-east. It makes a complete turn around the rugged buttress of Mount Ollivier, which marks the northward extension of the Sealy range, a subsidiary ridge to the Ben Ohau range. On the left side the ice-river is bordered mainly by the Moorhouse range, a portion of the island divide, on which stands the splendid serrate peak, Mount Sefton; but near its terminal faces it traverses the Hooker valley and abuts against the base of the long talus slopes from the Mount Cook range. The Mueller glacier is formed by the union of many small ice-streams which flow from the Sealy and Moorhouse ranges bordering it on either side. Some of the most splendid of these descend as magnificent ice-falls from the precipitous flanks of Mount Sefton. Avalanches, generally small, but sometimes of prodigious size, are constantly falling. The upper part of the Mueller glacier is free of moraine, but the lower part is thickly strewn with boulders, many of huge size. These are of grauwacke and argillite, together with various varieties of schist. The surface is much more irregular than that

of the Tasman glacier, rough ridges, sharp pinnacles, and deep hollows being everywhere encountered, while abrupt descents or minor ice-falls occur at several places. The Hooker river, flowing from the glacier of the same name, is strongly deflected by the Mueller glacier, just above its terminal face. The lateral moraines of the Mueller glacier are often of enormous size and remarkable height. Perhaps the largest are those occurring just behind the Hermitage, the Government accommodation house near the terminal face of the glacier. Here several parallel lateral moraines are to be seen, the highest having a local relief of quite 370

Mount Sefton.

Copland valley.

Fitzgerald pass.

MOORHOUSE RANGE.

feet. The outer ridges are clothed with thick alpine forest; then appear in succession ridges with mountain scrub, ridges gay in summer with alpine flowers and grasses, and nearest the ice, ridges of rough, bare morainic *débris.* In times of flood, the water dashes turbidly from beneath the high cliff of ice at the foot of the Mueller with tremendous force, rising geyser-like with the sudden relief of pressure, and carrying large stones down the stream. At times, also, some of the water bursts through the lateral moraines behind the Hermitage, and thus seeks exit to the Hooker river.

The Hooker Glacier.

The Hooker glacier occupies a deep valley between the precipitous slopes of the Mount Cook range and the broken, eastward-facing flanks of the Moorhouse range. It is formed by the union of many glaciers, which descend in huge ice-falls from the ridges on either side; but chiefly from Mount Cook itself and David's Dome—a fine snow-covered mountain which marks the termination of the Mount Cook ridge at the island divide. Like the Tasman, the Hooker occupies a strike valley. It has a length of nearly 7½ miles, and an average width of about half a mile. It is covered with heavy morainic *débris* for 4½ miles from its frontal face. The Hooker is bordered by splendid lateral moraines for many miles up its course. On the eastern side of the glacier opposite Fitzgerald pass, there are no fewer than six of these lateral moraines disposed in terraces, the lowest being on the edge of the present glacier.

Neither the Hooker nor the Mueller glacier shows any decided advance or retreat within recent years, though there have apparently been slight minor changes in the position of the terminal face. The following table,* prepared by Mr. T. N. Brodrick, Surveyor of the New Zealand Government, regarding the Tasman, Hooker, and Mueller glaciers, is of interest:—

Name of glacier.	Area of glacier.	Area of country from which supply of ice is drawn.†	Length of glacier.		Average width.		Greatest width.		Least width.	
	acres.	acres.	mls.	chns.	mls.	chns.	mls.	chns.	mls.	chns.
Tasman ...	13,664	25,000	18	0	1	15·0	2	14	0	50
Mueller ...	3,200	7,740	8	0	0	50·0	0	61	0	37
Hooker ...	2,416	4,112	7	25	0	41·3	0	54	0	30

The Valley of the Copland.

From the Hooker glacier a somewhat difficult route leads over Fitzgerald pass, in the Moorhouse range, into the wild and little-explored valley of the Copland. The route leaves the Hooker glacier about 3 miles above its terminal face. First, a long talus slope and couloir is ascended, then a tedious *arête*, leading on to a small ice-field deeply crevassed in several places, and lying just at the base of Fitzgerald pass. The descent to the tree-bordered bed of the Douglas river, the headwaters of the Copland, is first down a long gradual snow-slope, and then down a steep grassy slant bright with alpine flowers. About 5 miles below the western base of Fitzgerald pass the Strauchon river

* See paper on 'Ice Motion of the Canterbury Glaciers,' in the *New Zealand Alpine Journal*, October, 1894.

† It is not the whole watershed, but only that portion on which the snow lies.

joins the Douglas river from the north-east, and together they form the Copland river proper. The united stream, after a course of about 12 miles, joins the Karangarua, and together they flow to the sea, some 10 miles distant. There is a very small glacier, known as the Marchant, at the head of the Douglas river, above the point of descent from Fitzgerald pass, and a larger glacier, known as the Strauchon, at the head of the river of the same name. The Strauchon glacier descends from the base of Baker's saddle, which leads to the Hooker glacier near its head.

The Copland is a river flowing in a channel, which shows typically the influence of ice-action. One sees the U-shaped valley with gently

FOX GLACIER, WESTLAND.

curving moraine-filled floor, the smooth, precipitous enclosing walls of solid rock, and the tributary streamlets entering in marked discordance in grade, and often in steep falls, from valleys perched high above the main river. The scenery of the Copland is beautiful in the extreme. The bright blue water rushes in almost unending rapids in a channel strewn with huge boulders of fantastic shapes. On either side rises a forest of almost tropical splendour, gay in summer with the blood-red flowers of the rata and the rich creamy white blossoms of the hoheria. Above the valley floor, rises abruptly for thousands of feet the great rock walls, to which a scant but brilliant vegetation clings. Back from these precipices rugged ridges clad in alpine vegetation lead to the lofty snow-clad heights which are ever visible against the northern and southern skies, while to the eastward, splendid and

majestic, stand the giants of the Southern Alps—Mount Sefton, the Foot Stool, and others. Now and then one sees, close to the river-side, a waterfall of exquisite beauty break into the forest from altitudes hundreds of feet above, or again, in the distance, one catches a glimpse of some wild unknown glacier descending with wonderful ice-falls from some hidden snow-field in the mountains.

Travelling through the dense Westland forest with its thick matted undergrowth is exceedingly difficult, and walking along the bed of the river is, for the most part, impossible, owing to the numerous waterfalls and the boulders of huge size which strew the stream-bed.

Near Welcome flat, which is situated about halfway down the Copland, between the junction of the Douglas and the Strauchon and the point of union with the Karangarua, on the north bank of the stream there occur rather remarkable hot springs. These springs rise in a small flat-topped mound of brownish sinter, exhibiting miniature terraces. The plateau is surrounded by a luxuriant growth of tree fern, New Zealand flax, etc., while close at hand is a cave beneath an immense erratic, apparently but slightly removed from its original position, at the base of which a spring heavily charged with hydrogen sulphide occurs. The springs issuing in the sinter plateau are at a high temperature, but below the boiling-point.

The Copland resembles many another river of the west coast, which flows turbulently through this charming southern *terra incognita*.

The Franz Josef Glacier.

The Franz Josef glacier, in which the Waiho river rises, lies some 25 miles north of the Copland. The Franz Josef originates in a great field of *névé* lying near the base of Graham's saddle. Between Graham's saddle and Fitzgerald pass many splendid glaciers descend from extensive ice-fields which feed wild rapid rivers rushing to the Tasman sea. Perhaps the most prominent of these ice-streams are the Balfour and the Fox. The latter, a glacier of magnificent proportions, is unknown to the writer, but is said to originate in the most spacious and splendid snow-field to be found in the New Zealand Alps, not excepting the Tasman itself.

The great Franz Josef glacier forms one of the most wonderful and beautiful sights in New Zealand, and perhaps in the world. On reaching this glacier by way of the track which passes through the Westland forest and which is at present the sole highway through the wilderness, one is struck with amazement at the marvellous characteristics of this extraordinary ice-river. From this point, just below the terminal face, practically its entire course can be seen from where it originates high up on the slopes of Mount de la Bêche and the Minarets. Its gently curving course can be traced for the 8½ miles in which it descends over 8000 feet from a region of perpetual snow to its terminal face

UPPER TASMAN GLACIER.

—within 700 feet of sea-level, where its snout, a cliff of ice nearly 100 feet high and half a mile wide, is bordered on either side by a orest of rare beauty and of subtropical luxuriance and splendour. Here and there a waterfall leaps hundreds of feet from the mountain-sides on to the surface of the ice. The contrasts in the *ensemble* are amazing. From beneath the shade of a tree-fern or a mountain cabbage-tree, on an old lateral moraine of the glacier, one may look upon the much *séraced* and pinnacled clear ice of the glacier, and up on a gorgeous array of snow-clad peaks.

The surface of the Franz Josef glacier, for all of the lower $5\frac{1}{2}$ miles of its course, is exceeding rough, and is practically a continuous ice-fall —a maze of *séracs* and aiguilles, between which are deep crevasses and caverns. Compared with the glaciers on the eastern side of the Alps, the amount of moraine carried by the west coast glacier is in general remarkably small. This is apparently due partly to a much more abrupt descent of the Westland glaciers than those flowing to the east coast—a feature which gives a proportionately more rapid rate of flow and a consequently quicker removal of the waste material. It is also certainly due in part to a difference in the composition of the rocks on either side through which the ice-rivers flow. For instance, the upper part of the Franz Josef glacier is bordered by argillites and grauwackes, which continue to the eastward. The argillites easily disintegrate, and in disintegrating carry the interstratified grauwackes with them down the slopes. The lower part of the Franz Josef flows through hard schists of varied petrological composition, which do not decompose nearly so rapidly as the argillites. Thus while the principal west coast glaciers flow partly through hard rocks and partly through easily decomposed rocks, the east coast flowing glaciers around Mount Cook pass only through rapidly disintegrating strata. West coast glaciers, which flow only through the softer upper rocks, have a much greater proportionate amount of moraine than those which traverse the harder lower series of rocks as well. A good example of a west coast glacier, carrying much moraine, but flowing only through the easily decomposed strata, is the Strauchon, a tributary of the Copland river.

Glaciated surfaces * are beautifully apparent along the west coast glaciers. One sees well-polished rock walls, exquisitely smoothed *roches moutonnées*, abundant glacial scratching and gouging on the solid rock surfaces, and striæ on the morainic boulders. Most of this smoothing, striation, etc., is the result of past glaciation, and owes its excellent preservation to the hard nature of the rocks. Some of it, however, is apparently of modern origin, as striations at the very border

* See paper by Geo. Carrol Curtis in *Bulletin of the American Geographical Society*, February, 1906.

FOX GLACIER, SHOWING THE STRATIFIED ICE.

PINNACLED ICE OF THE FOX GLACIER.

of the ice and the many striated morainic boulders carried by the ice seem to testify. It seems probable, however, that glacial excavation at present is of very minor moment as compared with erosion due to this cause in the past. The movement of most of the west coast glaciers, for reasons already stated, is in general apparently much more rapid than on the east coast. Very little data is at present obtainable as to the exact rates of flow. Some years ago, during a reconnaissance survey of the Upper Waiho country, measurements were made of the rate of flow of the Franz Josef glacier by Messrs. G. E. Douglas and A. Harper, of the New Zealand Lands and Survey Department. Lines of rods were laid across the surface of the glacier; some showed a movement of as much as 200 inches per day, diminishing in others to 158, 132, 102, and down to 5 inches per day.* Such very rapid ice-movement is seen in very few places outside of the Arctic Regions.

The terminal face of the Franz Josef glacier has apparently advanced a few hundred feet within the last few years. This is apparently merely a local variation, due to the heavy snowfalls within recent years. In 1898, according to Mr. C. E. Douglas, the glacier was retreating.†

As the Baron von Hochstetter remarked, one would have to travel as far north as lat. 67° in northern Norway to see glaciers descend to so low a level as the Franz Josef glacier, which is in lat. 43° 35° S. of the equator. Even on the east coast the terminal face of the Tasman glacier stands only 2355 feet above sea-level—much lower than any of the Swiss glaciers at latitudes more remote from the equator. Practically, all mountains in the area now being described which rise above 7000 feet are covered with perpetual snow, and there are fair-sized snow-fields at even lower altitudes. The depression ‡ of the snow-level in New Zealand is apparently due in part to the disposition of a mountain chain at right angles to the direction of the prevailing moisture-laden wind, and in part to a moist climate, exhibiting a very small range of temperature.

Very little has been certainly or accurately ascertained as to the structure and main glacial characteristics of the heart of the Southern Alps. Many of the highest peaks are unscaled, numerous lofty passes untraversed; comparatively little is known about the wide extent of its snow-fields, the movements of its glaciers, and the peculiarities of its marvellous scenery. There are few areas which present such a wide field for varied exploration.

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* See 'Land and Survey Report, 1894,' p. 77 and diagram.

† See 'Report of the Department of Lands and Survey, New Zealand, 1897–1898,' p. 118.

‡ See also "Climatic Features of the Pleistocene Age," by Prof. Albrecht Penck, in the *Geographical Journal*, vol. 27, No. 2, p. 183.

POLISHED ROCK SURFACE, FOOT OF FOX GLACIER.

RESEARCH DEPARTMENT: THE WORK OF THE PAST SEASON.*

By Major C. F. CLOSE, C.M.G., R.E., Chairman.

DURING the past year the following investigations have been carried out at the instance of the Research Committee: (1) An investigation into the changes which have taken place in the eastern coast-line of England. A bibliography has been prepared by Mr. T. Sheppard of the Hull Museum. (2) An investigation into the amount of matter in suspension in rivers. This work is being carried out by Dr. Strahan; so far £70 has been spent on it. During the past year, also, the Council of the Society, on the recommendation of the Research Committee, has approved the offer of a grant of £100 a year for four years towards the measurement of $2\frac{1}{2}$ degrees of arc of the 30th meridian in Uganda. Grants towards this measurement have also been promised by the Royal Society, the Royal Astronomical Society, and the British Association. A committee composed of the President R.G.S., Sir G. Darwin, and Sir D. Gill have approached the Colonial Office on the subject, and it is understood that the Colonial Office regard the project favourably. It is certainly very desirable that the present opportunity of carrying out this important measurement should not be lost.

As regards the investigation of the East Coast changes, the Council inquired from the Royal Commission as to when their report might be expected, as there was some reason to fear that the Society's investigations might be superfluous. It was ascertained that it will be at least a year, if not more, before anything is published, and in the mean time the excellent bibliography by Mr. Sheppard is work of a character not attempted by the Royal Commission.

On the more general question of the functions of the Research Committee, it is clear that we should direct our attention to definite scientific ends, and leave the more popular side of geography to evening meetings. There are many branches of study which deserve the attention of the committee, but of these I will only mention four, viz. physiography, the application of geographical study to history, geodesy, and the theory of map-making. Taking physiography in its rigorous sense as the science which treats of the Earth's physical features, their formation and modification, we have an excellent example of a physiographical investigation in a paper given us by Dr. Woolacott on the physiography of Northumberland and Durham. In this study geography joins hands with geology; in fact, research of this character is impossible without the aid of geology.

As regards the second subject in my list, the application of geography to history, there is an excellent recent example of this in the

* Research Department, Annual Meeting, June 21, 1907.

examination carried out by Mr. Baring and General Renouard James into the Battle of Hastings. A detailed examination of the topography of the site of the battle has made it necessary to modify previous accepted conclusions, and strengthens the theory that the English and Norman armies were each only about 10,000 strong.

The third subject, geodesy, opens up a very wide field. It is wise of the Society to take geodesy under its wing, for it has no home elsewhere. On one side of course it is allied with astronomy, on the other with geology, but it is a science in itself which demands little less than the application of a lifetime. I may perhaps mention a matter which was told me by Dr. Teall the other day, *i.e.* that it has been suggested by Mr. James that the abnormal variation in local attraction in Banff should be examined with a view to ascertaining whether there are any metalliferous deposits near the surface. An examination of this nature is chiefly expensive because it costs *time*, and when observers have to be paid, the cost may easily mount up to some thousands of pounds. If, however, competent volunteers could be found, the cost would be insignificant. The investigation would be an exceedingly interesting one, and it would, moreover, be new. A thorough detailed geodetic examination of a limited area, say 4000 square miles, has never yet, I believe, been undertaken.

On the fourth subject, the theory or philosophy of map-making, a very interesting note appeared in the June number of the *Geographical Journal*, giving an account of the determination of the projective effect of colour-codes for maps by Dr. Brückner. It is a subject which has not yet received the attention which it deserves, and it is one which lends itself to experiment, and might very well be taken up.

I have mentioned these instances of some classes of useful research, partly to emphasize the fact that all research should be of a scientific character, but also partly to make it clear that in most cases it is not reasonable to expect that useful work will be done by busy men in spare moments of time. This sort of work is essentially for young men who can apply themselves definitely to research, and especially, I would suggest, for those who study in the schools of geography at Oxford and Cambridge.

REVIEWS.

EUROPE.

Structural Geography of Iceland.

Th. Thoroddsen, 'Island: Grundriss der Geographie und Geologie.' *Petermanns Mitteilungen*, Ergänzungsheft, No. 152, 1905, pp. 161, 1 map; and No. 153, 1906, pp. 358, 2 plates. Gotha: Justus Perthes. 22 *marks*.

Iceland is of special interest to British geographers, as it is the largest and most instructive volcanic area in Europe, and it was built by the same series of eruptions

as that which gave the western isles of Scotland some of their most conspicuous features. It has been studied by a succession of distinguished geographers and geologists, of whom the recognized authority on the island is Prof. Thoroddsen of Copenhagen. He visited it every year from 1881 to 1898, and has now summarized the results of his prolonged observations in a monograph on its geographical and geological structure.

Iceland consists essentially of a dissected volcanic plateau. It has an area of 104,785 square kilometres. Its foundation is a platform of basalt that rises in a plateau from 500 to 1000 metres high, above which smaller plateaus rise to the height of 1400 to 2000 metres. It is almost entirely composed of volcanic rocks, the exceptions being a small patch of gabbro on the south-eastern coast, some sedimentary deposits containing beds of lignite, and a patch of Pliocene shell beds of the same age as the English Red Crag. The basalt sheets that form the base of the island have been discharged in a succession of flows, which form a series 3000 metres in thickness, although the base is not seen. The basalts outcrop over half the surface of the island, most of the rest of which is covered by volcanic tuffs. Iceland belongs to the same volcanic province as the northern parts of the British isles, and its basalt series once extended to Greenland and Scotland. Iceland was part of a volcanic plateau the area of which was several hundred thousand square kilometres. This land existed last in Miocene times. It was broken up in the Pliocene by great earth-movements, by which the land around Iceland foundered beneath the sea. Iceland was thus left as an isolated earth block, which stood 250 metres higher above the sea surface than it does to-day. The island was also larger, as it extended on all sides for from 50 to 100 kilometres beyond its present coasts. The platform bounded by the 100-fathom line was then land, and was being cut through by valleys which still exist and are recognized by sounding. Dr. Thoroddsen denies the view, advanced by some botanists, that Iceland was connected by land with Europe in Pliocene or post-Glacial times. Pliocene erosion carved the Icelandic valleys, which Dr. Thoroddsen tells us existed essentially, as at present, before the beginning of the Glacial episode. The position of the valleys was largely determined by earlier earth-movements, while their contours have been moulded by the flow of the glaciers down them. The Icelandic valleys include several rift-valleys and two groups of fiords. The fiords are confined to the basalt areas in the north-western part of the island, and their origin has been long discussed. Dr. Thoroddsen summarizes the previous literature, and expresses his own conclusion that they are pre-Glacial valleys due to ordinary river-erosion, which have subsequently been enlarged by glaciers.

In contrast to the fiords are the broad bight-like bays on the coast, which are due solely to earth-movements, where blocks of the Earth's crust have foundered beneath the sea. The earth-movements began in late Miocene times, and are still in progress. Iceland shows evidence of great changes of level in reference to the sea surface. At the beginning of the great glacial advance the land was 100 metres lower than it is now. It subsequently rose 80 metres above the present level, but then sank, after a long rest at the 40-metre stage, to the existing level.

Of the Icelandic lakes, some are due to glacier dams, and some to water from melting glaciers collecting in hollows. Others occupy basins made by volcanic explosions, while the largest and most important lakes are of tectonic origin. The largest, Thingvallavatn, of 105 square kilometres and a depth of 111 metres, is due to direct earth-movements, as its south-western shore is part of a long fault scarp. The second largest, Lake Thorisvatn, has an area of 100 square kilometres, and occupies a basin formed by subsidence in an area of volcanic tuffs.

The glaciers are fully described. It appears that one of them only just misses

reaching the sea, as the snout of that at Breidamerk flowed, in 1904, down to only 9 metres above sea-level.

The volcanoes of Iceland have been the feature of most general geographical interest in the past. According to Dr. Thoroddsen, their chief characteristic is the discharge of great lava-masses through fissures, and without the formation of craters. The Icelandic volcanoes have, therefore, played an important part in the discussion of fissure eruptions.

The profound direct effects of faults on the topography of Iceland is well shown in Dr. Thoroddsen's description of its structure. This instructive monograph will doubtless take its place as the standard work on Icelandic geography, as it is the result of an almost lifelong study, made by a man whose writings impress on his readers confidence in his insight and judgment. J. W. G.

ASIA.

Indian Records.

Indian Record Series. 'Old Fort William in Bengal: A Selection of Official Documents dealing with its History.' Edited by the late C. R. Wilson, M.A., D.LITT. 2 vols. London: Murray. 1906. Pp. xl.–256, vii.–330. Size $9\frac{1}{2} \times 6\frac{1}{2}$. *Price 24s. net.*

Fort William, in Bengal, should ever live in the memory of Englishmen as the scene of the tragedy of the Black Hole on the night of June 20, 1756. The actual position of the prison was for long uncertain, but Dr. Wilson's investigations have cleared up the matter, and the site has now been preserved, and the position of the buildings, fortifications, etc., marked. This satisfactory result is in great measure due to the zeal of Lord Curzon, who took an active interest in Dr. Wilson's excavations. As an introduction to these volumes are printed Dr. Wilson's account of his work on the site, a description of the means taken to preserve and record the position of the different buildings, and an account of the ceremony at the unveiling of the monument to the memory of those who perished in the Black Hole, the monument being, as far as possible, a replica of that erected by Holwell, which was stupidly destroyed at the beginning of the last century.

The book proper consists of a selection of documents bearing on the history of the settlement. These consist principally of reports from the officers to the Board of Governors, and are of great interest and importance, and will be of considerable service to the historian and others working on the history of India. In addition to the contemporary documents, several articles bearing on the excavations have been reprinted from modern journals and newspapers. There are some excellent plans and illustrations of the old fort, and photographs of those parts which either still remain or have only recently been destroyed. There is also a good index.

Dr. Wilson has done his work well, and it is a matter for regret that he did not live to see the publication of his important book.

Early Enterprise in India.

'The English Factories in India, 1618–1621: A Calendar of Documents in the India Office, British Museum, and Public Record Office.' By William Foster. Oxford: Clarendon Press. 1906. Pp. xlvii.–379. Size 9 × 6. *Price 12s. 6d. net.*

This book is one for the historian rather than the general reader, being a calendar of the papers of the East India Company between the years 1618 and 1621, when there were but five English factories in the dominions of the Great Mogul. Where the papers are of peculiar importance or interest, Mr. Foster quotes them in full, but in other cases merely a *résumé* of their contents is given, this

method being that recommended by the Historical Manuscripts Commission. The documents have a very living interest, and show in a vivid manner the troubles and difficulties of the early traders, not only with the native rulers, but also with the other European trading companies, especially in connection with the attempt made by Sir Thomas Roe to revive the Red sea trade. Mr. Foster has added a useful introduction, in which he condenses the history of these three years, giving references to the original documents printed in the body of the book. The work, which must have been a laborious task, is well done, and Mr. Foster has laid under a debt of gratitude all persons working at the history of our early occupation of India.

THE SANTAL PARGANAS.

'The Story of an Indian Upland.' By F. B. Bradley-Birt, B.A., I.C.S. London: Smith Elder. 1905. Size 9 × 5½, pp. xiv. and 354. *Price* 12*s*. 6*d*. *net*.

Mr. Bradley-Birt, who is already well known by his book on Chota Nagpur, has in this volume undertaken the task of describing one of the most interesting districts of India, the Santal Parganas, and he has met with great success. Fascinated with the glamour of the East, and writing in a fluent and easy style, Mr. Bradley-Birt has produced a most vivid and entertaining narrative.

Where the Ganges takes its big southerly bend rise the Rajmahal hills, and in these hills live an aboriginal Dravidian people—the Paharias. Pushed by pressure from the west until they were brought to a stand in what has been called this *cul de sac*, the Paharias have dwelt for centuries among these mountain fastnesses, supporting themselves by raiding the plains, and from their hills have seen the Hindu and Mussulman empires wax and wane, leaving them uncontaminated and untamed. It was not until the advent of the British Raj that they were brought into some subjection, and the change was due to the genius of a young Englishman, Augustus Cleveland. Cleveland, who had a rare sympathy with the people, and who was only twenty-nine when he died, so arranged matters that the Paharias were left in possession of their hills, and a district at the foot, the Daman-i-koh, was also assigned to them. But the Paharias were afraid to leave their homes, and consequently these spurs of the hills were left unoccupied until the coming of the Santals, another aboriginal people, who, with a perfect genius for agriculture, soon turned what had been waste jungle into smiling fields.

Such are the people of whom Mr. Bradley-Birt writes, of their mode of life, their religion, their feasts and ceremonies, and he also adds a chapter on Deoghar, the sacred city of the Hindus, the home of Siva. The book is a model of what such books should be—a vivid narrative, well written, and full of sympathy for the subject with which it deals.

AFRICA.

SPECULATIVE ETHNOLOGY.

'The Origin of the Bantu: a Preliminary Study.' By I. F. van Oordt, B.A. Cape Town: Official Publication of the Cape Government. 1907.

Mr. van Oordt argues in this work that the Bantu languages owe their origin to the invasion—to two invasions (in about 1300 B.C. and 680 B.C.)—of North-East Africa by a "Sumerian" people from Mesopotamia, who introduced a "Ugro-Altaic" type of language into Negro Africa; in fact, the mother tongue of the Bantu. The Hottentots, Mr. van Oordt contends, are related anciently, not only in race but in language, with the Negrito Semang of the Malay peninsula. The Semang and the Sakai he believes to be related in language with the Mou-Annam, the Tibetan, Dravidian, and Ugro-Altaic peoples. The first of his

Bantu invasions (placed by him theoretically in about 1300 B.C.) brought into North-East Africa a Dravidian rather than an "Ugro-Altaic" element (linguistically), though, as the one (in his opinion) is fundamentally related to the other, this fact does not modify his general conclusion (p. 24), that the Bantu languages and those of the Ugro-Altaic race sprang from one common stock some 7000 years ago. (Mr. van Oordt elsewhere suggests that the immediate ancestors of the Bantu did not enter Africa, when they came "*by sea*," till about 3200 years ago; but several of his statements are mutually contradictory.)

Not content with this bold thesis, he carries his readers on to the "Malacca peninsula," where he believes "we shall find the origin of the Bantu." He then gives a comparative table of eight pages to show the supposed resemblances between word-roots in *Semang*, *Sakai*, and *Jakun* (Skeat and Blagden are his authorities for these citations), and roots of similar meaning in *Bantu* languages. Also other tables to show correspondence between roots in *Hottentot* and *Semang*; between *Bantu* and *Dravidian* tongues; and between *Shuna* (of Mashonaland) and *Assyrian*.

It is sufficient to say that these tables prove *nothing*, certainly lend no weight to Mr. van Oordt's speculations; do not, for example, prove that there is any marked resemblance or connection in syntax or word-roots between any set of Asiatic languages (except the half-African Semitic) and any group of African tongues, such as there is—marvellous to relate—between the Malagasy dialects and the speech of Polynesia. It is this staggering fact of the colonization of Madagascar from Sumatra or Java, across the Indian ocean, without contact with Africa, that alone excuses such wild theorizing as that of Mr. van Oordt. But he can give no proof to satisfy a trained philologist that the Bantu languages came from Asia, or that Hottentots and the Negritos of the Malay peninsula (after possibly a hundred thousand years of divergence from a common centre of origin) still maintain any linguistic connection. It should be added that the Bantu words and their etymologies quoted in this work are often misleading. Mr. van Oordt persistently mixes up the separable, changeable Bantu prefix with the actual word-root; and he cites, by some misapprehension, words which do not exist, or words borrowed from Arabic or Portuguese.

Incidentally, his bluebook is interesting because of the large number of Bantu languages illustrated (and some of them quite correctly), but it is a dangerous work for the uninitiated. It is disagreeable to have to write thus disparagingly of an Afrikander's work in African philology. I can only hope that Mr. van Oordt, so far from being discouraged by criticism, will take advantage of his position and residence in South Africa to give himself up to *detail* work, which is badly needed. Let him undertake researches into Shi-shuna, into the dialectal differences of the Kafir speech, into the North Kalahari language-field or the scarcely known idiom of the Berg Damara. Then the present writer will be amongst the readiest to thank him.

The fact is, it is sheer waste of time speculating on the non-African origin of the Bantu languages. This group is as much African as the Fula, Mandingo, lower Niger, Nyamnyam, and Nilotic language-families, with which it possesses features of fundamental relationship. What we now want from National South Africa is sound, first-hand research, not useless theorizing: work like that accomplished by Sir George Grey, Dr. Livingstone, W. G. Palgrave, F. W. Kolbe, and Dr. W. H. T. Bleek; and of late by the French, Swiss, and London Missionary Societies' pastors in South Africa.

H. H. JOHNSTON.

THE HERERO AND THEIR LAND.

'Die Herero.' Ein Beitrag zur Landes- Volks- und Missionskunde von Missionar I. Irle. 56 *Illustrations and* 1 *Map*. Gütersloh: C. Bertelsmann, 1906.

Herr Irle, who was a member of the Rhenish mission in Damaraland from 1869 to 1903, has given in 'Die Herero' a very useful summary account of the country in which he lived and the people among whom he laboured. In methodical German fashion the volume is divided into many sections and subsections, and a capitulation of the more important sections will best indicate the nature of the book. A short historical sketch from the time of the Portuguese discoveries is followed by a fairly detailed survey of the orographical and hydrographical features of the country, its climate, flora, and fauna. Having thus dealt with the land, Herr Irle next describes, at considerably greater length, the people; their origin, character, language, religion, family, and social life, and their culture generally. For information on all these points we are greatly indebted to the patient and painstaking research of the Rhenish missionaries, continued for over sixty years. The Herero, it may be noted, are classed as of ancient Bantu stock, as emigrants from the upper Zambezi, and as allied to the Ba-Lunda people. Chapters are also devoted to the "Hill Damara" and to the Bushmen. Next comes a narrative of the wars between the Herero and the Namaquas, and a record of the quasi-protectorate exercised by Britain through the Cape Government. Herr Irle points out the wholly legitimate character of this British protectorate, and shows that Germany only stepped in when England abandoned the field. The text of the treaty concluded between the Herero and the Germans in 1885 is given; a treaty which the Herero, who had no intention of alienating their land, did not fully understand. The relations of the Germans with the Herero up to 1904 are set forth, and though no account of the war which has devastated German South-West Africa is given, it will be seen that 'Die Herero' contains the information needed to enable a judgment on the causes of that conflict to be formed. An "Epoch Calendar" from 1820 to 1902 closes the first part of the book. The second part is devoted to the record of mission work, and demonstrates how completely the Herero are indebted to the missionaries for such advances as they have made in civilization. A simple sketch-map of Central Damaraland on a scale of 1 : 800,000 is given, and the illustrations, though roughly reproduced, illuminate the text.

F. R. C.

AUSTRALASIA AND PACIFIC ISLANDS.

THE BISMARCK ARCHIPELAGO.

Neu-Mecklenburg (Bismarck-Archipel): Die Küste von Umuddu bis Kap St. George.' Von Dr. Emil Stephan und Dr. Fritz Graebner. Mit 10 Tafeln, 3 Noten-Beilagen, Zahlreichen Abbildungen und einer Uebersichtskarte. Berlin: D. Reimer (E. Vohsen). 1907. *Price* 12 *marks*.

This copiously illustrated little book gives an account of an investigation by Dr. E. Stephan, a naval staff doctor, of the coastal peoples of the southern extremity of New Ireland. It gives a good account of the material life of various tribes, the details of the construction of their houses and canoes being elucidated by detailed sketches, and the native names of the parts are given. The most original and important of his observations deal with decorative art. The account of social conditions is very slight, and adds but little to what was previously known to occur throughout Melenesia generally; there is a dual division of each community, which has a bird for its emblem. "The children belong to the totem of the mother, that is to say, 'Mutterrecht' obtains." No details are given concerning "totemism,"

The classificatory system of kinship occurs, but no examples are given as to how it works out. No fresh light is cast upon the Dukduk secret society. Anthropometrical data are given of three individuals. A novel and interesting feature is a list of the people and their possessions (house, canoe, gardens, palms, pigs, fowls, dogs, and the like) in two villages. This idea might be copied and extended with advantage by other investigators. The essay by Dr. Graebner on the ethnographical position of the area in question is of considerable value; he is well qualified for the task, having recently published a valuable paper on "Culture Areas and Culture Layers in Oceania" (*Zeitschr. für Ethnologie*, 1905). By means of the map of distributions which he has compiled, one can see at a glance many of the affinities of the region in question. Maps of this kind afford a useful means of taking stock of our existing knowledge, and serve to give coherence to scattered observations.

A. C. HADDON.

SOUTH SEA ART.

'**Südseekunst.** Beiträge zur Kunst des Bismarck-Archipels und zur Urgeschichte der Kunst überhaupt.' Von Dr. Emil Stephan. Berlin: D. Reimer (E. Vohsen). 1907. *Price* 6 *marks.*

Dr. Stephan's book has a double value to students. In the first place, it is the record of a careful investigator who gives us full and accurate representations of objects from definite localities in Southern New Ireland, and the meaning of their decoration; though even he admits that "among the explanations to the plates are a number of native names the meaning of which can be made out only imperfectly, or not at all, as well as many patterns the native names of which could not be discovered." In the second place, it is evident from his remarks how unsatisfactory it is for students at home to attempt to elucidate native designs without first-hand knowledge. Among the many interesting facts discovered by Dr. Stephan, we may note that the most important animals, the dog and the pig, are never represented in art. Birds are extremely frequent, especially the frigate bird. Human representations are common, but the sex element is almost entirely lacking, and woman herself and all that relates to her sex are altogether absent. Heavenly bodies are rarely depicted, but other phenomena receive a most unusual attention. For instance, on two boats phosphorescent waves are painted, and common on bamboo boxes are conventional engravings of landscapes, still deep water, rain over sea which is stirred by a gentle wind, and stormy sea and rocks when the seething water is tossed on high.

In the essay on the æsthetics of the Bismarck islanders we have the general conclusions of a field-worker. His remarks on his own area must carry weight, but some of his comparisons with other fields may require reconsideration. It is possible that, had time permitted him to gain a deeper insight into the social groupings and the magical and religious ideas of the people under consideration, he would have found a significance which has so often eluded him. We may allow that there is no profundity in the artistic representations of these people, but that is quite different from denying that there may be a depth of significance greater than their "face-value." Our knowledge of the art of other peoples certainly permits us to expect that this will probably be found to be the case here also. The closing remarks of this valuable contribution to ethnography form an earnest appeal for further investigation by the German Government. The author also rightly says, "Instead of collections, let observations be our watchword, for books of careful notes are a far more valuable production of travel than great cases full of hastily collected objects."

A. C. HADDON.

GENERAL.

Surveying.

'Topographie Pratique de Reconnaissance et d'Exploration.' By E. de Larminat. 2nd edit. Paris: Henri Charles-Lavauzelle, 10, Rue Danton, Boulevard Saint Germain 118.

In this book M. de Larminat attempts the difficult task of supplying technical information in popular form. The publication of a second edition shows that his efforts have been appreciated. His preface dedicates his book to officers of the French army serving in the colonies; and he appeals to them to fill in their spare time by taking up sketching as a profitable and fascinating pursuit. Away with the notion, says he, that topography is solely a matter for experts. Every officer is equipped with sufficient elementary knowledge of the subject to be able to do most useful work, if given some practical hints—and here they are. Radiating encouragement by his own evident enthusiasm for the work, and banishing dulness by a charming style, M. de Larminat lures his disciples on to the heavier matters of understanding by a preliminary discourse on the correspondences between geological structure and topographical form. Then follow chapters dealing with compass sketching, triangulation, and field astronomy.

Generally speaking, the methods adopted are similar to those given in English and American text-books, with special reference to the patterns of French instruments. Calculation is as far as possible reduced to a minimum by the use of graphic method diagrams. Of the instruments dealt with, the compass and theodolite do not appear to be such good patterns as ours, nor is the plane-table given, perhaps, the attention it merits. The use of inaccurate instruments obliges the author to deal at length with methods of adjusting closing errors; and a fair criticism may be made that the labour so involved would be better devoted to obtaining more accurate work in the first instance. It must, however, be allowed that beginners are less likely to take up a study as a recreation which at first sight appears laborious; whereas, once committed to it, the interest excited will carry them through equal labours later on.

There is much of interest in this book; but on the whole, English officers and travellers with opportunities for topographical work before them, are already adequately equipped with handbooks in the present military text-books on the subject and the 'Hints to Travellers.'

Perhaps, however, there is an opening for a popular exposition of those same methods written with a view to attract recruits, a book where the asperities of scientific language are softened by a chatty style, and a pervading sympathy with a beginner's difficulties. To wield at once the wands of science and literary art is a *tour de force*; and those who aspire to do this cannot do better than study this work by M. de Larminat.

E. P. B.

A New Text-book.

'The Oxford Geographies.' Vol. iii., Senior. By A. J. and F. D. Herbertson. Oxford: Clarendon Press. 1907. Pp. viii. + 363. *With maps and diagrams. Price 2s. 6d.*

As the first two volumes of this capital series were reviewed at some length in the May issue of the *Journal*, a brief notice of the third and last book will suffice to indicate its position in the triple scheme. The first book was mainly descriptive, the second more definitely causal in its treatment of the different regions of the globe; this combines both systems, with a very strong emphasis on the second. The idea is to carry school geography up to a point at which university work may

profitably begin. The main drawback that we noticed in vols. i. and ii., viz. the "stiffness" of subject-matter and diction, in the nature of things vanishes in vol. iii., and we have a book well adapted either for teachers' study or students' examination. Assuming that their readers already possess some concrete knowledge of the world as a whole—no perfunctory assumption by any manner of means—Dr. and Mrs. Herbertson proceed to consider geography according to natural climatic regions as distinct from the more orthodox classification into political divisions. As, however, after all the latter tend to approximate to the former, no great shock to the feelings of the old-fashioned teacher will be sustained. A glance at the table of contents will show the scheme. The headings for Africa are illustrative: "The Mid-world Deserts," "The Sudan," "The Guinea Lands," "The East African Savanas," "Africa south of the Zambezi," "African Islands," while the north-west corner is included in a preceding heading, "The Mediterranean Region," which naturally deals principally with Europe.

We are glad to note that, as in vol. ii., the *human* element is everywhere. The gaps in the chalk of south-east England, and the consequent effects on the growth of Kent and Sussex towns, the influence of climate and physical features on the economic geography of Japan, or the lessons conveyed in the distribution of English and Scotch names in the south island of New Zealand, are instances to the point. The numerous maps and diagrams are, with few exceptions, most illustrative. The exceptions are those which—well enough in their way, even if a trifle indistinct in places—are hardly necessary. The routes and towns, for instance, of the Balkan Peninsula, of Italy, of Spain (Figs. 6, 7, 8), and of every other country, are better and more clearly shown in good school atlases than in a little square some 3 to 4 inches each way. Uniformity—an essential for purposes of comparison—also suffers when there are allowed to appear on opposite pages two maps, dealing with the same region, wherein solid black is used to delineate in the one the highlands over 3000 feet, and in the other the fertile soils of the Barbary States (Figs. 10, 11). On the other hand, such educational studies as the sketch of Lower Andalusia (Fig. 9), with its explanatory note and letterpress, or even the somewhat complicated diagram of the routes from Vienna (Fig. 23), also with full explanations, are excellent. They *make* the student refer to his big atlas, and they make him think. The resourceful teacher will make good use of these sketch-maps, and will find in them abundant material for the "exercises" recommended by the Board of Education in its "suggestions" to geography masters and mistresses. Any one who cares to try should sample Figs. 60–67 (Climatic Conditions of the Monsoon Lands); they contain a wealth of suggestion.

E. R. W.

Exercises in Physiography.

'An Introduction to Practical Geography.' By A. J. Simmons and H. Richardson. London: Macmillan & Co. 1907. In three parts. *Price 1s. each.*

In the preface this book is stated to have grown out of a collection of exercises for Prof. Gregory's revision of Huxley's 'Physiography.' Its title is somewhat ambiguous, and would have been more descriptive of the contents had it been 'Practical Physiography.' If it is not a practical geography, at least the needs of the future geographer have been borne in mind, with the result that any school boy or girl who has gone through a course judiciously selected from the numerous exercises in the book will be exceptionally well prepared for geographical work.

Section I. contains elaborate exercises on measurements by pacing, chain, ruler, compass, and square paper. It is full of hints, not merely for the geographer who

wishes to train his pupils in the construction and use of maps, but for the teacher of arithmetic and mechanical drawing.

Section II. begins with measurements on globes, and passes to latitude and longitude, correlating the exercises with co-ordinate geometry, the teaching of which might well be based on the exercises as are given here. Sun and shadow and sun-dials are dealt with very fully, and lead up to problems in longitude and time, day and night, and the seasons. This section is closed by a chapter on map projections, which unfortunately contains a common error about Mercator's projection in Figs. 116 and 120, where the central cylindrical projection is illustrated and described under the name of Mercator. Two polar projections are shown, but the name is given only to one, which ought to have been called the central polar projection.

The third section deals with climatic, or rather with meteorological, observations and with weather, the climatic studies being confined mainly to the British Isles. The successive chapters are on the measurements and representations of temperature, pressure, rainfall, moisture, and the observations of frost, snow, and ice. The section is full of very valuable exercises, but when gravimetric determinations of the mass of water-vapour, the construction of a barometer, and volumetric experiments are suggested, we do not understand why simple experiments on specific and latent heat were omitted. They are very important preliminaries to geographical work in upper classes, and if the objection is that they are not geographical, that applies to a very large proportion of the exercises in the book. Except for the British Isles, the fundamental climatic geographical exercises are hardly touched upon, although an infinite variety of interesting and valuable exercises can be devised.

The fourth section deals with land and sea. River waters are analyzed, and a number of questions relating to different kinds and parts of rivers are suggested which will prove useful in geographical excursions. In the second chapter of this section, admirable questions involving the use of maps are inserted, and might with advantage have been extended. In the chapter on the sea, the composition of sea-water, surface waves, and tidal movements are dealt with, but the great currents of the ocean are neglected. The third chapter suggests exercises in plant geography in a series of questions which are well drawn, but, again, too little attention is paid to map studies other than those of the immediate neighbourhood, for which, however, there are a few excellent exercises. The last chapter, on Man's dwelling-place, is very scrappy.

The book, as a whole, is obviously the result of much thought and of experience in teaching. Its great merit is that it suggests lessons in advanced nature studies, or physiography, many of which at the same time may be used in classes of arithmetic, mathematics, physics, and chemistry. It is modern in its efforts at co-ordinating studies. Further, the exercises are of great practical value, and are a definite preparation for geographical work. We wish that the ordinary student had a quarter of the knowledge which would be obtained by any one working systematically through this book, before he came to seriously study geography in the university. The publication of the book in three parts is a great value, as it allows the exercises to be taken in a three years' course.

THE MONTHLY RECORD.

EUROPE.

The Evolution of the Shannon.—A paper in the *Proceedings of the Royal Irish Academy* for March, 1907, by Mr. J. R. Kilroe, of the Geological Survey, discusses the question of the geological history of the Shannon and its basin. It is

necessarily to a considerable extent based on hypothesis, but some interesting points are brought out. In tracing the present contours of the basin and its bounding heights, the author points out the slight elevation above the sea and extreme flatness of the limestone plain (as compared with the greater elevation of the sandstone hills), as well as the insignificant fall between Lough Allen and the estuary. The level along the watershed falls in places below 200 feet, and a lowering of less than 300 feet would bring the waters of the ocean into the basin from three different sides. The striking accordance in the summit levels of the principal groups of Irish mountains, at between 2500 and 3000 feet above the sea, is held to indicate that the original Shannon drainage was developed on a surface occupying this level, which the author, following the school of Prof. W. M. Davis, is inclined to regard rather as a peneplain than as a plain of marine erosion. In the formation, since Eocene times, of the present surface features, a differential erosion of something like 2500 feet has thus to be accounted for, and the discussion of this question occupies the greater part of the paper. From a consideration of the river's discharge and the probable proportion of mineral substances contained in the water, Mr. Kilroe arrives at 30,000,000 years as the length of time required by the process under the ordinary sub-aërial agencies, though it must be confessed that guesswork enters very largely into the calculation. This seeming to him to be a somewhat excessive length of time, he considers whether it might be shortened by calling into play the action of ice. He thinks that there are undoubted indications that the gorge at Killaloe, in its later stages, was cut by ice, and that the irregular contours of the bed of Lough Derg above the gorge also point to the same agency—the case of Lake Iseo, in Lombardy, investigated by Dr. Hess, being cited as a parallel instance. He is, however, disinclined to attribute to ice the great erosive power assigned to it by many continental and American geographers, and thinks that the differential lowering of the surface, resulting in the present features, is more consistent with the mild reduction due to sub-aërial waste than with the supposed drastic force of an ice-sheet. Yet he suggests that ice may have helped to remove material already worked upon by atmospheric agencies, thus shortening the process, though he does not make it clear how the whole of this vast amount of waste can have been carried away by the narrow Killaloe gorge, through which—and not by the Scarriff valley, once utilized by the lower Shannon—he supposes the glacier to have passed.

Geography and Demography of Lower Languedoc.—An article by M. Max Sorre, of 112 pages, in the *Bulletin* of the Languedoc Geographical Society (vol. **29**, nos. 2, 3, 4), deals with the relation of the geography to the distribution of population in Lower Languedoc, the subject being further illustrated by maps. The great diversity of races that from early times has possessed the land has favoured the adjustment between its very diverse soils and its humanity. Occupied from prehistoric times, the land has been the home of Iberians and Ligurians; of Volcae, many of whose "vici" subsist; and of Romans. By way of the sea, again, the land received the impress of Phœnician and thence of Greek civilization. Agde and Rhodanusia are transplantations from Marseilles. In the Middle Ages cities like Montpellier and Cette grew up. Within the last fifty years agricultural crises have upset the economy, and therewith the normal equation, of the geography and demography of the land. The two main sources of wealth are viticulture and sericulture. First appearing in France in 1863, phylloxera in less than nine years ruined the vineyards of Gard, and by 1881 overtook all Hérault. In the wake of the phylloxera there followed, in the region of the vine, a corresponding decline of population, notable particularly in towns of more than 3000 inhabitants. Thereon succeeded the silk blight, and with it a corresponding shrinkage of population in Ardèche, Gard, Hérault, and Drone. To supply the

depletion in the plains, an afflux of population from the mountains set in, and an equilibrium is now once more in process of re-establishment. To exhibit the normal relation between land and population, the article distributes the country into twelve natural regions, each comprising a number of demographic groups, *i.e.* communes topographically contiguous and of like density of population, the mean density of each group being indicated on the map. A commentary on the map analyzes each of the regions in respect of its geology, hypsometry, hydrography, culture, and, as the resultant of all these, its demography. Each region is further illustrated by a cartoon representing the different characters of its soils and the corresponding distribution of population. The paper includes a special study of the rural population, agglomerate and dispersed, and a summary estimate of the geographical, climatic, cultural, and geological factors of population.

The Language Question in Switzerland.—This question has been a good deal to the fore of late, in part owing to the formation of the *Deutschschweizerischer Sprachverein*—an association for the diffusion of German in Switzerland. The view that the Romance languages are likely in future to give way still more than in the past before the Teutonic is contested by M. R. Henry, who has for some years made a study of the question on the spot, and has published, in the *Questions Diplomatiques* for April 1 of this year, a language map of Switzerland showing the position at the present time, accompanied by a brief commentary. Besides summarizing the broad facts of language distribution, the writer notices some of the influences which tend to the diffusion of one or other of the languages. In the most thoroughly French cantons—those of Geneva, Vaud, and Neuchâtel—the old patois have entirely given place to French, which thus, M. Henry thinks, possesses some advantage over the German language, of which many separate dialects are still spoken in the German portions of the country. Some of the industries, such as watch-making, attract French artisans, who carry their language with them; but, on the other hand, many German-speaking workmen have flocked to the industrial centres of the Bernese Jura, and the question whether these will adopt the French language spoken around them is one of the most practical questions of the moment. Railways exercise a considerable influence, and the writer considers that the piercing of the Simplon will adversely affect the German language of the Haut-Valais, though the effect of the piercing of the Loetschberg would be just the contrary, as placing the Germans of Valais in closer communication with their linguistic allies. The influence of railways is to be seen also in the Grisons, where the linguistic isthmus at present connecting two areas of Romansh-speaking people south-west of Coire will evidently be cut through in the near future.

ASIA.

Ethnographic Explorations in Arabia Petræa.—The well-known Austrian Arabist, Prof. Alois Musil, has lately described his researches in a report to the Imperial Academy of Sciences in Vienna and in an address to the Geographical Society there. In his journeys Prof. Musil had more in view than the investigation of natural features and the discovery of the remains of an outworn culture. His aim was also to learn how the present inhabitants feel, think, and live; what are their traditions; their religious, social, and political views; their morals, customs, and songs; their food, their employments;—everything, in short, connected with the life they live. In this investigation he was no doubt prompted by the conjecture that among these inhabitants of the deserts numerous echoes of the oldest intuitions would survive. Researches of this kind are among the most interesting, but also the most difficult that can be prosecuted. It is difficult to gain the confidence of the people, and more difficult still to transplant one's self into their spiritual level and

frame one's questions aright. It does not do, for example, ever to make direct inquiry for the information wanted. You must begin with perfectly innocent questions, and in every case let the person answering have his full say out. In the case of each tribe Prof. Musil made inquiry about its subdivisions, clans, and families, its insignia, traditions, and watering-places. In that way he learnt what were the ideas formed by the natives of the origin of a tribe, what clans were distinguished by them as autochthonous and what as immigrant, what particular knowledge they had of the origin of the different clans, etc. Many traditions may, on the authority of literary documents, be dated back many hundreds of years. From an inscription in one of the castles of the caliphs discovered by him, Musil was able to confirm and supplement one of the traditions. Many tribes have a vocabulary of their own, as also peculiar morals and customs distinguishing them from their neighbours. That made it necessary for the scholar to extend his ethnographic inquiries over all peoples, both settled and nomadic, in Arabia Petræa, and even in the case of several tribes to make more specific distinctions. The settled inhabitants call themselves "Fellâhîn." It is only the nomads or camel-rearers that are styled "Arabs;" the title of "Bedawin" is given to them only by way of nick-name. The former alone are Mohammedans. The latter have a primitive Semitic religion, with neither priest nor temple. While the volumes "Moab" and "Edom" contain the topographic, the manuscript laid before the Academy in May contains the ethnographic report of the journey. It presents, as it were in mosaic, a strictly faithful picture of the life of to-day in Arabia Petræa. Musil describes the life of no less than forty-eight different tribes, and joins a literal translation with all the texts cited. The letterpress is illustrated by seventy pictures from photographs taken by the traveller himself. This ethnographic report of his journey will, it is probable, appear in print as volumes **4** and **5** of the whole work before the end of the year. A part containing the "Epigraphy" is still to follow. Next year Prof. Musil thinks of returning to the scene of his fruitful investigations, it being his intention to visit the region bordering Arabia Petræa on the east, which on all maps still shows a white blank.

Ascent by Dr. Longstaff in the Himalayas.—On July 1 a telegram was received in this country from Dr. T. Longstaff, announcing his successful ascent on June 12 of the peak of Trisul, in the Garhwal Himalayas. He was accompanied by the two Brocherels, the well-known Italian guides, and by the Gurkha native officer Karbir. The peak lies to the south-west of Nanda Devi, and its height, as given by the Trigonometrical Survey of India, is 23,406 feet above sea-level. Further particulars will be awaited with interest.

Dr. Wegener in Central China.—Dr. G. Wegener, of Berlin, who has for some time been a student of the geography and economic conditions of the Far East, has lately completed a journey in various parts of China and neighbouring regions, the results of which are likely to be of considerable interest. One of his latest journeys took him to one of the least-known parts of Central China, in the province of Kiangsi, which, as Dr. Wegener points out, possesses a marked geographical unity from the fact that it is virtually coextensive with the basin of the Poyang lake, and its main feeder the Kan. Although the route by this river was once so important a line of communication between Northern and Southern China, and as such was used by many of the early European embassies, its importance has greatly declined with the development of sea traffic, and it has been strangely neglected by scientific travellers in modern times. Dr. Wegener says that his outward route through the east of the province had not previously been traversed by any European, and his journey will form a useful supplement to the investigations by Mr. Consul Clennell, referred to in the *Journal*, vol. **27**, p. 301. In order

to avoid the rains and accompanying fever, the traveller visited Kiangsi at a season when the lake and rivers were at a low stage, their navigation being somewhat difficult. When crossing the Poyang lake on the outward journey, many sand-banks were showing above its surface, and on the return it was little else than an expanse of sand traversed by river-channels. It is from this source that the sand of the extensive dune-formations of this region is derived. From Nanchang, where the first beginnings of the advent of Western influence were observable, Dr. Wegener took the route up the valley of the Fu river, the second largest in the province, which in a not very near future may serve as the route of a railway to Fukien, as that of the Kan may to Canton. The traveller passed through the great rice-field of Lower Kiangsi, one of the most thickly populated agricultural regions in the world, and found that the lowlands extended further in this direction than is shown on the maps, the mountains beginning only in the neighbourhood of Kienchang. Even here the river-valley forms a wide break between the mountains occupying the interval between the Kan and the Fu rivers and those on the Fukien border. Dr. Wegener ascended the Hsinfong Shan, probably the highest mountain in the province, and found its height, by boiling-point thermometer, to be 5320 feet, or greater than has been supposed. The Kiangsi mountains make a more imposing impression than their mere height would warrant, owing to their steep, sierra-like forms, and the deeply cut valleys. The ranges hardly form a continuous *massif*, but rise like islands above the general level, their general nature confirming the brilliant guess of Richthofen. Dr. Wegener crossed the water-parting between the Fu and the Kan, and reached the main headstream of the latter, which proved to be the Ningtushui, and not, as has been supposed, the Kung. This section of the route led through a region as untouched by civilization as any within the Chinese Empire. The descent of the Kan (which is broken in places by rapids, though, as the river rises over 12 feet, they should be quite passable by river steamers in summer) led through a district in which the sugar-cane is the principal object of cultivation. By far the most important town on the river is Kingan-fu, while some that have long appeared on the maps as important places have been eclipsed by more modern ones. The plain of the lower Kan (which had already been visited by Mr. Clennell) is in great part meadow-land.

Survey Work in Seistan.—In the "Report of the Board of Scientific Advice for India" for 1905–06, which anticipates by a considerable space of time the ordinary Annual Survey Report for the same period, Colonel Burrard refers to the excellent geographical work done in Seistan by Mr. G. P. Tate, of the Survey of India, who was attached to the Seistan Mission under Sir H. McMahon, and made a geographical survey of 42,000 square miles on the scale of 4 miles, and 3000 square miles on the 1-mile scale. Mr. Tate's map and memoir are now being prepared, and as the latter will contain accounts of the ancient and modern topography of Seistan, as well as its archæology and ethnology, its interest will be readily appreciated. Mr. Tate estimates that the Seistan oasis, which is really the delta of the Helmand, supports a population of 105,000. The Hamun or lake into which the Helmand pours its waters is nowhere deeper than 10 feet; its area is about 2000 square miles. The further study of the physical conditions of the lagoon will no doubt throw light on the desiccation of the region in question; at present Colonel Burrard inclines to the belief that the sand is slowly regaining the mastery over the water, and that the rivers will be eventually stopped or practically dried up. This, however, must in some measure depend on the irrigation works that may hereafter be constructed, and that may conduce to the regeneration of the country and the possible improvement of the climate. Colonel Burrard himself makes mention of the well-known fact that in ancient times large and important irrigation works

existed in the valley of the Helmand river, and that their decay and ruin have been a material factor in the desiccation of the land.

The Sanpo.—In the same report Colonel Burrard gives a short note calling attention to the peculiar feature in the hydrography of the Sanpo that all its principal tributaries have a tendency to flow in a direction contrary to that of the main stream. This Colonel Burrard accounts for by the surmise that at no very distant date the Sanpo flowed from east to west along its present trough, and that the several tributaries were developed during that period of the river's history. Later on he supposes that the river formed a great lake in South-Eastern Tibet, which overflowed across the southern ranges, and gradually cut a gorge through them. The same process, it is remarked, is happening in Kashmir where the Jhelum is carving a gorge; the drainage of the Kashmir basin has but one outlet, and overflows at the lowest notch in the rim of the basin. At the point of overflow a deep chasm is being cut in the Pir Punjal range.

AFRICA.

Egypt and the Sudan in 1906.—The latest annual report on Egypt and the Sudan contains, as usual, a large amount of information on the progress of those countries, and offers a special interest as being the last to be sent in by Lord Cromer before relinquishing his arduous but brilliantly executed task as British agent. Only a few points of interest can here be touched upon. Since the satisfactory conclusion of the frontier question in the Sinai peninsula it has been decided to put an end to the dual control over that area, and bring the whole under the War Department, a British officer acting as Mudir and Commandant. The economic condition of the country is still spoken of as thoroughly sound, and although the cotton area had suffered some reduction, the largeness of the crop had put matters on a favourable footing, for the time being at least. The Nile flood of 1906, if not a really good one, at least came up to the average, which could not be said of those of the seven previous years. The Assuan reservoir fulfilled its functions admirably, contributing daily from 6 to 20 millions of cubic metres from May 10 to July 21, when the flood water had already arrived. Nothing is said in the report regarding the heightening of the dam, which has apparently been decided on since the date of its preparation. A marked increase is recorded both in the number of passengers and the amount of goods carried by the railways, while details are given of the important works lately executed at the port of Alexandria. With regard to the Sudan, attention is called to the huge distances which separate the principal towns, and the prime necessity is shown to be an improvement of communications, without which it would be premature to undertake irrigation works on a large scale. The opening of the Red Sea and Nile railway is too recent to have yet had any very marked results in the way of commercial development. One of the most important desiderata is the opening up of the Ghezireh or tract between the Blue and White Niles, and as a first step towards this, a grant has been made for a bridge over the Blue Nile between Khartum and Halfaya. This will be followed by a line of railway up the middle of the tract, with branches to both rivers. A report by Sir W. Garstin on the possible irrigation of this area is printed in an appendix. It recommends, in the place of a flood-canal (which would allow only dhurra to be raised), the construction of a barrage and canal giving irrigation-water after the flood has passed along. By this means wheat could be cultivated over half a million acres, cotton-growing being also possible. The area in the Ghezireh that could be eventually irrigated, north of Wad Medani, is estimated at between 3 and 4 million acres. Good progress was made during 1906 with the telegraph line to the south, and communication with Gondokoro

was shortly to be opened through the Bahr-Ghazal province, the break in the line due to the marshes between Taufikia and Meshra-er-Rek being bridged over by a weekly service of oil-launches. Navigation on the Nile, etc., had been actively maintained, and 1000 tons of building material, stores, etc., had been transported up the Jur river to Wau. It had not been yet found possible to open up direct water-communication with the French Congo, but steps had been taken to survey the route for the proposed railway through the Lado enclave. Careful surveys had been made by Mr. Walsh and other officers of the irrigation service in the region of swamps of the White Nile, a traverse being made (among others) along the line proposed for a new channel of the upper river.

Geology and Ethnology of Madagascar.—The researches of French students continue to add to our knowledge of the great African island, and though hypothesis must still largely enter into any discussions of its past history, whether physical or ethnological, this is now supported by an increasingly large body of facts. Since M. Gautier's work on the physical geography of the island appeared in 1902, a good deal of geological work has been done, especially by Prof. Lemoine, who sketches the present position of our knowledge (with special reference to economic geology) in the *Revue de Madagascar* for February 10 of this year. His own studies have been devoted to a large extent to the sedimentary formations by which the old crystalline massif is flanked, especially on the west. Unlike M. Gautier, who considered the oldest of these to belong to the Trias, M. Lemoine assigns the important series of sandstones which immediately overlie the Archæan rocks to the Lias; and as similar formations occur on the African coast, he places at this epoch the first separation of the old "Gondwana" continent into an Australo-Indo-Madagascan and an Africano-Brazilian portion, the Mozambique channel then acquiring an importance which it has never since lost, although Madagascar must, he allows, have been temporarily united to Africa to permit the immigration of the lemurians in early Tertiary times. From the economic point of view the old crystalline rocks are the more important, though the coal deposits found in other parts of the Gondwana region are absent; and the gold has hitherto been rarely found in the form of veins, but is most often disseminated throughout the mass of the gneiss and granites. Iron, copper, graphite, and asbestos also occur in this section. In the sedimentary rocks, the abundance of limestone in the west and north will permit of the exploitation of lime and cement, at least for local needs. In the same number of the journal alluded to, M. G. Ferrand, of late years one of the most zealous students of the history and ethnology of the island, summarizes his conclusions on these subjects, largely based on comparative linguistic studies. He considers that there is absolute evidence of a Sanskrit element in Malagasy, pointing to an immigration of Hinduized Malays, probably from Sumatra. Its date is placed within the first millennium of our era. It was preceded, in M. Ferrand's view, by an important Bantu immigration, indicated, *inter alia*, by Bantu elements in common words (*umbi*, ox; *undri*, sheep, etc.) occurring in all the dialects known during the sixteenth century, and in all modern dialects. The supposed Jewish immigration is treated as a myth, while there is held to be no justification for applying the term "Indo-Arab" to the invasions which Islamized the east coast. The mention of the last Abbaside khalif, in a document from the island preserved in the Paris National Library, is considered to point to an Arab immigration about the middle of the thirteenth century, while evidence of a Persian immigration also exists. M. Ferrand has also evolved some new notions respecting the structure of the Malagasy language.

AMERICA.

Recent Work of the Geological Survey of Canada.—The Summary report for 1906 on the operations of this survey shows that a large amount of excellent work was done during the year, though rather of the nature of detailed examination of fairly well-known areas than of exploration further afield. It is proposed in future to adopt the plan of working from the known to the unknown, devoting the chief attention to such regions as are likely to come to the front from the point of view of economic development. Thus in 1906 much of the work consisted in a careful examination of tracts along the routes of proposed railways, especially the Transcontinental and Hudson bay lines. Prof. J. Macoun studied the country to be traversed by the former between Portage la Prairie and Edmonton, and found that, though communications are still undeveloped, settlers have already established themselves in many parts, and are raising excellent crops. The constant record was rich soil and immense wheat-fields. The 100 miles west of Touchwood made a particularly favourable impression. There is practically no bad land, and the alkaline flats of former writers are the best wheat-fields of to-day. Mr. McInnes' explorations along the proposed line of the Hudson bay railway, to the north-east of the lower Saskatchewan, yielded some matter of geographical interest. He divides the region into three areas—the first underlain by the horizontal or gently undulating magnesian limestones of Northern Manitoba; the second, an Archæan area, forming a somewhat broken and rugged country extending from the northern edge of the limestone escarpment until covered by the lacustrine sediments of the third or clay area. It is this last only that contains much ground suitable for cultivation, the arable lands being chiefly confined to the old basin of the glacial Lake Agassiz, the sedimentation in which supplied the existing soil-cover—a friable deep-brown clay with admixture of vegetable matter. Though generally wooded, the trees are small in size, but from their slow growth would furnish firm and strong timber. The climate seems suitable for general agricultural operations, no frosts being experienced in the summer of 1906 until the night of September 29. Mr. O'Sullivan, who examined the country between Split lake and Fort Churchill, reports favourably on the latter as a port, and says that there seem to be no great difficulties in securing a good line for the railway along the route followed. Mr. Collins explored the Trans-continental route west from Lake Nipigon, through a portion of the Archæan peneplain of this region. The surface is practically one of solid rock, the impervious character of which, coupled with the low relief, favours the accumulation of a vast amount of water in superficial depressions. The western portion is auriferous and iron-bearing; but further east the country is rugged and of little economic importance. The work of several field-parties was devoted to the study of the mineral resources of various parts of Canada, and an important result was the discovery by Mr. Dowling of a large coal-field extending north from the Saskatchewan to past the Brazeau. In the oil-fields of Southern Alberta encouraging indications have been obtained, though the practical results of operations have hitherto been small. Mining in the southern part of the Yukon has given encouraging results, the copper deposits in particular having proved extraordinarily rich.

Survey of the Northern Frontier of Bolivia.—Further letters from Major P. H. Fawcett (see *Journal*, vol. 29, p. 574) give a detailed account of his ascent of the upper Aquiry from Bahia, in company with Mr. A. J. Chivers. The journey up and down occupied all but a couple of months, Bahia being left on December 26 and reached again on February 23. The Aquiry, in this section of its course, Major Fawcett describes as purely a rain river. At Bahia it will rise in from one to four

days and fall in a similar period, while higher up it has been known to fill in a night and fall in a day, a drop of 6 feet in seven hours being recorded by the expedition on one occasion. From the start the course of the river was found to be extremely tortuous, and the action of the rain-floods is always tending to increase the sinuosity. Hence Major Fawcett concludes that an exact survey would serve no useful purpose for more than a few years. Considerable difficulty was experienced in the ascent, owing to the numerous snags and sandbanks. The canoes had frequently to be hauled over great trees bridging the river, or, when this could not be done, had to be emptied, sunk, and passed underneath the trunks. Above the mouth of a small tributary named the San Lorenzo, the character of the Aquiry changes completely, the river becoming a series of cachuelas, or rapids, flowing over hard sandstone and connected by long quiet reaches almost devoid of current except at high flood, when the cachuelas are blotted out. Towards the end the stream narrowed to a width in places of only a yard or two, and ultimately a point was reached, named by Major Fawcett the Cascada Inglesa, beyond which it was impossible, with the men and the appliances available, to get the canoes. The flow of water was very feeble, and Major Fawcett estimates that the spot must be within 9 or 10 miles of the actual source, though the latter is probably almost indefinite. A record of the visit was left with a note of the position of the Cascada, which was calculated to be approximately in lat. 11° 5′ S., long. 70° 15′ W. Between the Cascada and Bahia (11° 1′ S., 68° 47′ W.) it was calculated that the Aquiry falls 119 metres (390 feet). On the return journey opportunity was taken to explore the Yaverija, a tributary which joins the Aquiry at a rubber station called Tacna, and which in character is very similar to the main stream. It is the largest tributary of the Aquiry above Bahia, and has at its mouth a width of 15 yards, the width of the Aquiry at this point being 25 yards. Rumours had been heard of the existence of a huge fossil head high up the Yaverija. What was found was the fossilized head of an ancient crocodile, probably some 15 to 18 yards in length. Though no doubt once a very fine specimen, the head had been to a great extent broken up by Indians and gumpickers. The huts of the latter extend for a distance of three days' journey up the Yaverija and are also scattered along the banks of the Aquiry in between the barraccas, or rubber stations. The last station encountered on the Aquiry was a little above Tacna, and at the time of the commission's visit had been established only six months. In all the settlements rubber is common currency, and when the river is full steamers and launches ascend some distance above Bahia to engage in trade. Major Fawcett does not, however, paint a very bright picture of the general conditions, which have radically changed since Chandless ascended the Aquiry in 1864. The barbaros, or savage Indians, had not then been subjected to raids by labour-hunting parties, and were of a friendly disposition; the "monte" or forest was well stocked with game, and the rivers with ducks. Now Major Fawcett reports that matters are reversed. Of the savage Indians the commission saw only such indications as the remains of camp-fires and small dugout canoes, and unless an expedition carries its own supplies it must be prepared to starve. Chandless's map, or the reproduction of it seen by Major Fawcett, is to-day incorrect in many respects, particularly, Major Fawcett is convinced, in representing the Aquiry as extending to long. 71° 10′ W.

Swedish Expedition to Tierra del Fuego.—Mr. Carl Skottsberg, one of the members of the recent Swedish Antarctic Expedition, sends us some particulars as to a new scientific expedition to the extreme south of South America which he is organizing. He will leave Gottenberg in September, accompanied by two young scientific experts, Messrs. P. Quesnel and T. Halle, both primarily geologists, though the latter is also a clever bryologist. The expedition will not sail in a ship

of its own, but will make use of the ordinary mail steamers and coasting vessels for transport to the scene of action, where the main work will be done on land. Tents, sleeping-bags, and the necessary apparatus for botanical, geological, zoological, and meteorological work, will be taken. Proceeding *viâ* Buenos Aires and Montevideo to the Falklands, the leader and Halle will there spend the summer of 1907–8 for the purpose of continuing the researches begun by the Swedish Antarctic Expedition, Quesnel meanwhile going to Punta Arenas, where he hopes to make an excursion to the Cerro Payne region. On reuniting at Punta Arenas, the party will, if time permits, make an expedition to the northwards along the Cordillera and round Otway and Skyring waters, before winter sets in. This will be spent in the rainy region of the western channels, and in the spring an attempt will be made to reach Lago Fagnano, the party then moving its headquarters to the region of Beagle channel. It is proposed to conclude the summer's work with a trip to Tekeenika bay, returning to Sweden in April or May, 1909.

AUSTRALASIA AND PACIFIC ISLANDS.

Visit to Dutch New Guinea.—Mr. A. E. Pratt has lately paid a visit to Fak-Fak—a small station with a Dutch assistant resident and some Chinese and Arab traders—on the south coast of New Guinea, just east of McCluer inlet. What civilization has reached the spot has been derived chiefly from the Arabs, who have a mosque and have made a good many nominal converts among the coast natives. The houses are fairly well built. A fine lately paid by the hill natives for an attack on the station consisted in some old bronze cannon—an interesting memento of the early Portuguese voyages to these parts. The forests contain wild nutmegs, dammar, and valuable timber; and the fauna includes, besides birds of paradise, a gigantic black and gold butterfly (*ornithoptera*) measuring 8 inches from tip to tip of the wings, and a tiny cockatoo, only 2½ inches long, including crest. Bêche de mer and pearl shells occur on the reefs, and the bays are said to be infested with great cephalopods, which, according to the natives, have been known to attack canoes.

POLAR REGIONS.

Dr. Charcot's Proposed Antarctic Expedition.—We have received from Dr. Charcot further details respecting the plans for his new expedition, which have already been briefly referred to in the *Journal* (vol. **29**, p. 464). In discussing the objects to be kept in view, the explorer lays stress on the importance of penetrating as far as possible into the unknown, while at the same time disclaiming the intention of risking the scientific results for the sake of mere vain-glory. The choice of the same field of exploration as on the former expedition was made, after due consideration of the plans of other expeditions now being organized or projected, for the following reasons: (1) The importance of gaining further knowledge of the almost unknown Alexander I. Land; (2) the possibility of the existence in that region of an ice-barrier similar to that of Ross, over the surface of which an advance could be made; (3) the advantages of continuing the scientific work begun by the former expedition, and utilizing the experience gained by it; (4) the support to be expected from the Argentine Republic in view of the excellent relations entered upon on the former occasion. While recognizing the advantages that might accrue from the provision of a second ship, the available funds are not likely to admit of this. As has already been announced, a ship will be specially built for the expedition, and Dr. Charcot, who has made a careful study of all the points to be kept in view in its construction, hopes that the work may soon be definitely put in hand. While large enough to permit the carrying on of scientific work under

suitable conditions, the ship will be small enough to enable it to navigate in safety along the coasts and to seek shelter in small coves. Besides ordinary sledges, it is proposed to take motor-sledges for possible use on the surface of an ice-barrier. As already announced, Wandel island is chosen as the final base of operations, and from this it is hoped to explore the coast of Alexander I. Land as far as possible, choosing winter quarters on the land, and thence undertaking expeditions into the unknown area, scientific work being at the same time prosecuted at the base. During the second summer an attempt would be made to navigate westward as far as possible in the direction of King Edward VII. Land, and supplies will be taken to admit of a second wintering in case of necessity.

GENERAL.

A Rapid Journey round the World.—A Fellow of this Society, Colonel H. Burney Campbell, writes to announce his return from a journey round the world in the exceptionally short time of 40 days 19½ hours. Needless to say, the journey was made by the Canadian Pacific and Siberian railways, and did not therefore cover the full circumference of the globe, but, as Colonel Campbell points out, he traversed the full extent of the largest land masses of the world. It has, of course, long been recognized that since the opening of the Siberian railway the circuit of the world could be accomplished in a surprisingly short time, but we are not aware that Colonel Campbell's record had previously been attained. He was on the whole fortunate in making his connections, though he came near missing that at Vladivostok by running aground in the sea of Japan.

CORRESPONDENCE.

The Inclosure of Common Fields.

Dr. Gilbert Slater, in the January number of the *Geographical Journal* (pp. 35–55), has attempted to connect the growth of the English inclosures with the survival in certain districts of a Keltic type of village community, and he illustrates his theory by a very striking map (p. 40). It is, however, somewhat difficult to bring the facts revealed in this map into close relation with known history. The western boundary of Dr. Slater's inclosures does, indeed, coincide roughly with the limit of peaceful civilization during the first four centures of our era. But that limit itself is due not so much to racial as to geographical considerations. The civilization extended as far as the hills of Yorkshire and Derbyshire, Wales, and West Somerset, and there it stopped, because the uplands were ill suited to it. A still greater difficulty arises on the eastern boundary of the inclosures. The inclusion of Essex and Suffolk and the omission of Norfolk, the inclusion of the West Sussex littoral and the omission of Kent and half Surrey and three-quarters of Sussex cannot be easily explained as racial; nor does it appear to be simply geographical. A better solution has been suggested to me by Mr. J. Rose, of Oxford, with whom I was lately discussing Dr. Slater's article. He bade me compare Dr. Slater's map with the geological map of England. The result was to convince me that geology, that is, the nature of the soils, has been a potent factor—though doubtless not the only one—in determining the growth of the inclosures shown on the map, and it seemed worth while briefly to lay this suggestion of Mr. Rose before other readers of the *Journal*.

F. Haverfield.

Christ Church, Oxford.

The Heights of the Central African Lakes and Mountains.

Since the publication of the article in the *Journal* of March, 1907, I have received a communication from Mr. R. E. Allen, Director of Surveys, Uganda Protectorate, in which he says that a line of levels has been run from Lake Victoria at Entebbe to Lake Albert at Butiaba, and that the difference between the two was found to be 1692 feet.

This is the result of levelling one way only, so there has been no check on the figures. Nevertheless, we must now regard the height thus determined as the most reliable value for Lake Albert (2028 feet above M.S.L.).

The height published in the *Journal* was 1937 feet, obtained by an aneroid difference between Lake Albert Edward and Lake Albert.

Dr. Kohlschütter has kindly taken the trouble to send some remarks on the heights published in the same article. He considers that the probable error assigned to the difference in height between Muhavura and Lake Tanganyika is far too small, for the following reasons :—

1. He does not think Muhavura's apex is sufficiently well defined to ensure the same point being taken as the highest from every direction.

2. The probable error of the Kivu triangulation should be greater, as it was of a rapid order, and the coefficient of refraction which was used has never been stated.

He does not think it possible, judging by the results of the whole of his barometric determinations in East Africa, that his height could differ from any determination, with a p.e. of $\pm$ 13 feet, by as much as 58 feet.

The mean error of a single barometric determination after elimination of the climatic factors by his method is $\pm$ 33 feet, and the barometric height of Tanganyika given is the result of eight months' continuous observations.

T. T. Behrens.

The Dar Homr.

Daglingworth House, Cirencester, July 2, 1907.

The copy of the *Journal* for June, 1907, has just reached me from Egypt; in it I notice some notes on Dar Homr by Captain W. Lloyd (p. 649), and send you the following remarks :—

1. The southern boundary is Bahr el Arab and the river Kir.

Note.—The Bahr el Arab is the river Kir, and takes this name " Kir " when it enters the Dinka country either before or after joining with the rivers that join the river Lol below Sultan Robs.

2. On the map in two places it is entered, " To Dar Jange."

Note.—Does this convey anything to any one who studies the map? I presume not. Dar Jange = to Dinka country. The Dinkas are called by the Arabic-speaking races Jange, or in the western part of the Bahr el Ghazal it is more correct to say " Junge."

3. " Liang are numerous."

Note.—Am I mistaken in this word? I have never yet heard of such a beast. Should it not be " Tiang," a sort of hartebeest very common in the Bahr el Ghazal and on the lower reaches of the Bahr el Arab?

C. Percival,
Captain, Rifle Brigade.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k.k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE

England and France—Communication. **Rodakowski.**

"The Channel Ferry." The feasibility of a train-ferry between England and France. Compiled by Ernest de Rodakowski. London: Harrison & Sons, [1905]. Size 10 × 6½, pp. xvi. and 236. *Maps, Plans, Diagrams, and Illustrations.*

Europe—Zoogeography. **Scharff.**

European animals: their geological history and geographical distribution. By R. F. Scharff, PH.D. London: A. Constable & Co., 1907. Size 9 × 5½, pp. xiv. and 258. *Maps and Illustrations. Price 7s. 6d. net. Presented by the Publishers.*

Considers the present distribution of various elements of the European fauna in its bearing on past changes in the configuration of the surface.

France. **Baedeker.**

Southern France and Corsica. Handbook for travellers by Karl Baedeker. 5th edition. London: Dulau & Co. (Leipsic: K. Baedeker), 1907. Size 6½ × 4, pp. xxviii. and 578. *Maps and Plans. Price 9s. Two copies, presented by the Editor and Publishers.*

France—Brittany. **Vallaux.**

La Basse-Bretagne. Étude de geographie humaine par Camille Vallaux. Paris: Ed. Cornély et Cie., [1907]. Size 10 × 6½, pp. 320. *Maps. Price 7.50 fr. Presented by the Publishers.* [To be reviewed.]

France—Coasts. **Girard.**

Jules Girard. Les falaises de la Manche. Paris: E. Leroux, 1907. Size 11½ × 7½, pp. 194. *Maps, Plans, and Illustrations. Presented by the Publisher.* [To be reviewed.]

France—Loire-Inférieure. **Quilgars.**

Dictionnaire topographique du département de la Loire-Inférieure comprenant les noms de lieu anciens et modernes. Rédigé par H. Quilgars. Nantes: L. Durance, 1906. Size 11 × 9, pp. liv. and 318. *Presented by the Author.*

The information in the bulk of the work is limited to a definition of the locality of the places, but the introduction includes some interesting notes on the history of the Department.

Germany—Heligoland. **Brohm.**

Helgoland in Geschichte und Sage. Seine nachweisbaren Landverluste und seine Erhaltung. Von Brohm. Curhaven, Helgoland: A. Rauschenplat, 1907. Size 13 × 10, pp. 72. *Maps, Sections, and Illustrations. Price* 12*s.*

An excellent monograph on the island, well illustrated.

Germany—Rhine. **Baring-Gould.**

A book of the Rhine from Cleve to Mainz. By S. Baring Gould. London: Methuen & Co., 1906. Size 7½ × 5, pp. xii. and 346. *Sketch-map and Illustrations. Price* 6*s.*

Iberian Peninsula—Historical. **Maguire.**

The British Army under Wellington, 1813-1814. A summary by T. Miller Maguire. London: W. Clowes & Sons, 1907. Size 9 × 5½, pp. 50. *Maps and Plans. Price* 4*s. Presented by the Publishers.*

Iceland—Cartography. *B.S. Belge Géologie* **20** (1906): *Procès-Verbaux*, 144-149. **Prinz.**

Les premières cartes à grande échelle de l'Islande. Par W. Prinz.

On the topographical map on the scale of 1 : 50,000, the publication of which has been begun by the Danish general staff.

Italy—Apennines. *B.S.G. Italiana* **6** (1905): 444-464. **Jaja.**

Escursion nei Sibillini (Appennino centrale). Del dott. Goffredo Jaja. *With Sketch-map and Illustration.*

Italy—Seismology. *Beiträge zur Geophysik* **8** (1907): 293-362. **Hobbs.**

The geotectonic and geodynamic aspects of Calabria and North-Eastern Sicily. A study in orientation. By William Herbert Hobbs. *With Maps and Diagrams.*

Italy—Tuscany. *Riv. G. Italiana* **13** (1906): 596-603. **Toniolo.**

Cavità di disfacimento meteorico nel Verrucano del Monte Pisano. Del dott. Antonio Renato Toniolo. *With Illustrations.*

Italy—Venetia. *Mem. S.G. Italiana* **11** (1905): pp. 192. **Béguinot.**

Saggio sulle flore e sulla fitogeografia dei Colli Euganei. Del dott. Augusto Béguinot. *With Map.*

Italy—Venice. **Magrini and Others.**

Reale Instituto Veneto di Scienze, etc. Ricerche Lagunari, per cura di G. P. Magrini, L. de Marchi, ed. T. Guesotto. Nos. 1-3. Venice, 1906. Size 10½ × 7, pp. (No. 1) 12, (No. 2) 18, and (No. 3) 22. *Illustrations and Diagrams.*

Discusses methods, etc., to be adopted for the researches lately inaugurated in regard to the lagoon of Venice (*Journal*, vol. **27**, p. 298).

Lake of Constance. *Globus* **90** (1906): 229-232. **Halbfass.**

Ist der Bodensee ein internationaler See? Eine Studie zur Anthropogeographie der Seen. Von Prof. Dr. W. Halbfass.

Discusses the political status of the Lake of Constance, as to which questions have lately arisen.

Portugal. **Hume.**

Through Portugal. By Martin Hume. London: E. Grant Richards. 1907. Size 7½ × 8, pp. xiv. and 318. *Illustrations. Price* 5*s. net. Presented by the Publisher.*

Pyrenees. **Baring-Gould.**

A book of the Pyrenees. By S. Baring-Gould. London: Methuen & Co., [1907]. Size 7½ × 5, pp. vi. and 310. *Map and Illustrations. Price* 6*s. Presented by the Publishers.*

Pyrenees. **Briet**

Voyage au Barranco de Mascun. Par Lucien Briet. Pau, 1905. Size 10 × 6½, pp. 52. *Illustrations.* (Also Spanish translation, from the *B.R.S.G. Madrid*, tome **48**. Madrid, 1906. Size 9½ × 6, pp. 52. *Illustrations.*)

Contains some striking photographs of this ravine.

Russia—Finland—Coasts. *Fennia* **21** (1903-04): No. 3, pp. 14. **Bonsdorff.**

Ueber die Hebung der Küste Finlands und den mittleren Wasserstand des Ostsee. Von A. Bonsdorff.

Russia—Finland—Lakes. *Fennia* 20 (1902–03): No. 7, pp. 108. **Palmén.**
Seespiegelsenkungen in Finland. Von E. G. Palmén. [In Swedish, with German summary.] *With Maps.*

Russia—Kanin Peninsula. *Fennia* 21 (1903–04): No. 6, pp. 72. **Ramsay and Poppius.**
Bericht über eine Reise nach der Halbinsel Kanin im Sommer 1903. Von Wilhelm Ramsay und B. Poppius. *With Map and Illustrations.*

Russia—Lappland. *Fennia* 20 (1902–03): No. 5, pp. 60. **Borg.**
Bericht über die geographischen Resultate einer Forchungsreise in den Grenzgegenden von Finnisch und Russisch-Lappland im Sommer 1901. Von Väinö Borg. *With Maps.*

Spain—Andalusia. *B.R.S.G. Madrid* 48 (1906): 426–499. **Pérez.**
La Alpujarra y Sierra Nevada. Por Eduardo Soler y Pérez. *With Map and Illustrations.*

Sweden—Klar Elf. *Ymer* (1906): 383–414. **De Geer.**
Om Klarälfen och dess dalgång. Af Sten de Geer. *With Map and Diagrams.*

Switzerland—Aargau. **Gilbart-Smith**
The cradle of the Hapsburgs. By J. W. Gilbart-Smith. London: Chatto & Windus, 1907. Size 8 × 5, pp. 216. *Illustrations. Price 5s. net. Presented by the Publishers.*

An account of the fortunes of the Hapsburg dynasty and of its early associations with Northern Switzerland.

Switzerland—Place-names. *Deutsche Erde* 5 (1906): 170–182. **Blocher and Garraux.**
Die deutschen Ortsnamenformen der Westschweiz. Von Eduard Blocher und Emil Garraux. *With Map.*

United Kingdom—Yorkshire. **Roth.**
The Yorkshire coiners, 1767-1783; and notes on old and prehistoric Halifax. By H. Ling Roth. Halifax: F. King & Sons, 1906. Size 10 × 7½, pp. xxviii. and 322. *Illustrations. Presented by the Author.*

There is an interesting chapter on the Frobishers of Halifax, traders and explorers in the Canadian North-West towards the close of the nineteenth century.

ASIA.

Baluchistan. **Dames.**
Popular poetry of the Baloches. By M. Longworth Dames. (Publications of the Folk-lore Society, lix.) 2 vols. in 1. London: D. Nutt, 1907. Size 9 × 5½, pp. (vol. 1) xl. and 204; (vol. 2) 224. *Price 15s. net. Presented by the Publisher.*

This work is "the result of many years' labour in collecting, transcribing, and translating the ballads and verses here set forth." The author has enjoyed the co-operation of the Royal Asiatic Society, which has rendered it possible to include a complete collection of the original texts, and of the Folk-lore Society, which has issued the work as one of its annual volumes.

Chinese Empire. **Broomhall.**
The Chinese Empire: a general and missionary survey. Edited by Marshall Broomhall, with preface by the Rt. Hon. Sir Ernest Satow. London: Morgan & Scott, [1907]. Size 8½ × 5½, pp. xxiv. and 472. *Map and Illustrations. Price 7s. 6d. net. Presented by the China Inland Mission.*

Although written specially from the point of view of missions, this forms an excellent general description of the Chinese Empire, the several chapters being contributed by writers specially qualified, from personal knowledge, to treat of the separate provinces.

Cyprus. **Hutchinson and Cobham.**
A Handbook of Cyprus, compiled by Sir J. T. Hutchinson and Claude Delaval Cobham, 1907. London: E. Stanford, 1907. Size 7 × 4½, pp. xii. 132. *Maps and Portrait. Price 2s. 6d. net. Presented by the Publisher.*

Eastern Asia. **Weale.**
The truce in the East and its aftermath; being the sequel to 'The re-shaping of the Far East.' By B. L. Putnam Weale. London: Macmillan & Co., 1907. Size 9 × 5½, pp. xvi. and 648. *Maps and Illustrations. Price 12s. 6d. net. Presented by the Publishers.*

Eastern Asia. **Zepelin.**

Der Ferne Osten: seine Geschichte, seine Entwickelung in der nuesten Zeit und seine Lage nach dem russisch-japanischen Kriege. Von C. von Zepelin. I. Teil. (Russland in Asien, Band viii.) Berlin: Zuckschwerdt & Co., 1907. Size $9\frac{1}{2} \times 6\frac{1}{2}$, pp. 276. *Map and Plans. Price* 6*s*. 6*d*.

India. **Yusuf-Ali.**

Life and labour of the people of India. By Abdullah Yusuf-Ali. London: John Murray, 1907. Size $9 \times 5\frac{1}{2}$, pp. xvi. and 360. *Illustrations. Price* 12*s*. *net. Presented by the Publisher.*

India—Burma. **Scott.**

Burma: a handbook of practical information. By Sir J. George Scott. London: A. Moring, Ltd., 1906. Size $7\frac{1}{2} \times 5$, pp. x. and 520. *Map and Illustrations. Price* 10*s*. 6*d*. *net. Presented by the Publisher.*

India—Ethnology. **Crooke.**

Natives of Northern India. By W. Crooke. London: A. Constable & Co., 1907. Size $9 \times 5\frac{1}{2}$, pp. xiv. and 270. *Map and Illustrations. Price* 6*s*. *Presented by the Publishers.*

See review in the June number, p. 665.

Japan—Formosa. **Takekoshi.**

Japanese rule in Formosa. By Yosaburo Takekoshi; with preface by Baron Shimpei Goto. Translated by George Braithwaite. London: Longmans, Green, & Co., 1907. Size 9×6, pp. xvi. and 342. *Maps and Illustrations. Price* 10*s*. 6*d*. *net. Presented by the Publishers.* [To be reviewed.]

Korea. **Hulbert.**

The passing of Korea. By Homer B. Hulbert. London: W. Heinemann, 1906. Size $10\frac{1}{2} \times 7$, pp. xii. and 474. *Illustrations. Price* 16*s*. *net.*

An excellent account of Korea and the Koreans, by one who has resided in the country and is familiar with the language.

Malay Archipelago—Borneo. **Nieuwenhuis.**

Quer durch Borneo. Ergebnisse seiner Reisen in den Jahren 1894, 1896–97, und 1898–1900. Von Dr. A. W. Nieuwenhuis; unter Mitarbeit von Dr. M. Nieuwenhuis. Zweiter Teil. Leiden: E. J. Brill, 1907. Size $11 \times 7\frac{1}{2}$, pp. xiv. and 558. *Plates. Price* 19*s*.

The first volume was reviewed in February, 1905 (vol. **25**, p. 202).

Malay Archipelago—Celebes. *Rev. Française* **31** (1906): 626–631. **Barré.**

Les Célèbes; une expedition hollandaise. Par Paul Barré.

On the military expedition of 1905 against the rebel rajah of Boni.

Siberia—Amur. ———

Explorations géologiques dans les régions aurifères de la Sibérie. Région aurifère de l'Amour. Livraison V. St. Petersburg, 1904. Size $10 \times 6\frac{1}{2}$, pp. 146. *Maps.* [In Russian; *résumé* in French.]

Siberia—Lena. **Cajander.**

Acta S. Sc. Fennicæ **32** (1906): No. 1, pp. vi. and 182; No. 3, pp. 40.

Beiträge zur Kenntniss der Vegetation der Alluvionen des nördlichen Eurasiens. Von A. K. Cajander. I. Die Alluvionen des unteren Lena-Thales. *With Maps.* Studien über die Vegetation des Urwaldes am Lena-Fluss. By the same.

Siberia—Lena. *Fennia* **19** (1902–03): No. 2, pp. 44. **Cajander and Poppius.**

Eine naturwissenschaftliche Reise im Lena-Thal. Von A. K. Cajander und R. B. Poppius.

Tibet. *Mem. Asiatic S. Bengal* **1** (1906): 413–419. **Francke.**

The Dards at Khalatse in Western Tibet. By the Rev. A. H. Francke. *With Illustrations.*

Turkey—Palestine. **Thomsen.**

Loca Sancta. Verzeichnis der im 1. bis 6. Jahrhundert n. Chr. erwähnten Ortschaften Palästinas, mit besonderer Berücksichtigung der Lokalisierung der biblischen Stätten. Von Peter Thomsen. I. Band. Halle-a.-S.: Rudolf Haupt, 1907. Size $9\frac{1}{2} \times 6\frac{1}{2}$, pp. xvi. and 144. *Map. Price* 6*s*.

A dictionary of the place-names of the Holy Land as mentioned in early writers,

with special regard to their identification. The alphabet is completed in the present volume, and it does not appear with what subjects the second volume will deal.

Turkey—Palestine. *Österr. Monatschrift f.d. Orient.* **32** (1906): 133–135. ———
Die Judenkolonien in Palästina.

Turkey—Railway. *Quest. dipl. et col.* **23** (1907): 1–20. **Henry.**
L'Asie turque et le chemin de fer de Bagdad. Par René Henry. *With Maps.*

AFRICA.

Abyssinia. *B.S. Belge études col.* **13** (1906): 673–716. **Boulvin.**
Une mission belge en Ethiopie. Par Fritz Boulvin. *With Illustrations.*

The writer accompanied M. Hénin to Abyssinia in 1905 on his appointment as Belgian Consul-General at Addis Ababa.

Abyssinia—Phytogeography. *Sitzungsber. K. Preuss. A. W.* (1906): 726–747. **Engler.**
Ueber die Vegetationsverhältnisse von Harar und des Gallahochlandes auf Grund der Expedition von Freiherrn von Erlanger und Hrn. Neumann. Von A. Engler.

Africa. **Baden-Powell.**
Sketches in Mafeking and British East Africa. By Major-General R. S. S. Baden-Powell. London: Smith, Elder, & Co., 1907. Size 9½ × 12¼, pp. xii. and 184. *Illustrations and Sketch-map. Price 21s. net. Presented by the Publishers.*

Africa—Ethnology. *T. South African Philos. S.* **16** (1906): 401–412. **Péringuey.**
On rock-engravings of animals and the human figure, the work of South African aborigines, and their relation to similar ones found in Northern Africa. By L Péringuey. *With Illustrations.*

Africa—Exploration. *Deutsche Erde* **5** (1906): 202–206. **Hahn.**
Deutschlands Anteil an der Afrikaforschung. Von Friedrich Hahn. *With Maps.*

Africa—Railway. *J.S. Arts* **55** (1906–07): 97–109. **Michell.**
The Cape to Cairo railway. By the Hon. Sir Lewis Michell. *With Map.*

British Central Africa. *Scottish G. Mag.* **23** (1907): 72–86. **Angus.**
On the frontier of the western Shiré, British Central Africa. By H. Crawford Angus. *With Map.*

British East Africa. *Tour du Monde* **13** (1907): 13–36. **Alluaud.**
De Mombassa au Victoria-Nyanza par l'Uganda Railway. Par Charles Alluaud. *With Map and Illustrations.*

Canary Islands. *Globus* **90** (1906): 312–316, 329–332. **Knebel.**
Studien zur Oberflächengestaltung der Inseln Palma und Ferro. Von Walther von Knebel. *With Maps and Illustrations.*

Cape Colony—Geology. ———
Cape of Good Hope: Department of Agriculture. Tenth annual report of the Geological Commission, 1905. Cape Town, 1906. Size 9½ × 7, pp. 296 and vi. *Maps and Sections.*

East Africa. **Bulpett.**
A Picnic Party in Wildest Africa: being a sketch of a Winter's Trip to some of the Unknown Waters of the Upper Nile. By C. W. L. Bulpett. London: E. Arnold, 1907. Size 9½ × 6, pp. xvi. and 246. *Map and Illustrations. Price 12s. 6d. net. Presented by the Publisher.*

Egypt. **Dicey.**
The Egypt of the Future. By Edward Dicey. London: W. Heinemann, 1907. Size 7½ × 5, pp. 216. *Price 3s. 6d. net. Presented by the Publisher.*

The greater part of the book deals with the present position in Egypt, considered, however, in reference to the outlook for the future.

Egypt—Sinai. **Schoenfeld.**
Die Halbinsel des Sinai in ihrer Bedeutung nach Erdkunde und Geschichte, auf Grund eigener Forschung an Ort und Stelle dargestellt von Prof. Dr. E. Dagobert Schoenfeld. Berlin: D. Reimer, 1907. Size 10 × 7, pp. viii. and 196. *Map and Illustrations. Price 8m. Presented by the Publisher.*

French Sudan. **Desplagnes.**
Lieutenant Louis Desplagnes. Le Plateau Central Nigérien. Une mission archéo-

logique et ethnographique au Soudan français. Paris: É. Larose, 1907. Size 10 × 6½, pp. 504. *Map and Illustrations. Price* 12 *fr.*

Supplies the most detailed information we yet possess on the region of the Middle Niger, especially its populations. It will be reviewed in an early number.

German East Africa. **Paasche.**

Deutsch-Ostafrika. Wirtschaftliche Studien von Dr. Hermann Paasche. Berlin: C. A. Schwetke und Sohn, 1906. Size 9 × 6, pp. iv. and 430. *Illustrations. Price* 8*s.*

A systematic description of the most important districts of German East Africa from an economic point of view, with general discussions of the possibilities of cultivation of various products.

Madagascar—Bibliography. **Grandidier.**

G. Grandidier. Bibliographie de Madagascar. Deuxième Partie. Paris: Comité de Madagascar, 1906. Size 10 × 6½, pp. 435–906. *Presented by the Comité de Madagascar.*

See note on Part i. in *Journal*, vol. **27**, p. 646.

Togo—Language. **Seidel.**

Lehrbuch der Ewhe-Sprache in Togo (Anglo-Dialekt). Mit Uebungsstücken, einem systematischen Vokabular und einem Lesebuch. Von A. Seidel. Heidelberg: J. Groos, 1906. Size 8 × 5, pp. viii. and 176. *Presented by Mr. D. Nutt.*

NORTH AMERICA.

Alaska. *B.U.S. Geol. Surv.* **278** (1906): pp. 54. **Collier.**

Geology and coal resources of the Cape Lisburne region, Alaska. By Arthur J. Collier. *With Maps, Sections, and Illustrations.*

Alaska. *B.U.S. Geol. Surv.* **280** (1906): pp. 54. **Prindle and Hess.**

The Rampart gold placer region, Alaska. By L. M. Prindle and Frank L. Hess. *With Maps and Illustrations.*

Alaska. *Petermanns M.* **53** (1907): 1–16. **Rühl.**

Ueberblick über die geographischen und geologischen Verhältnisse Alaskas. Von Dr. Alfred Rühl. *With Map.*

Based on the work of A. H. Brooks. The map gives in handy form the results of all explorations up to date, with insets showing the surface features, geology, etc.

Alaska—Malaspina Glacier. **Tarr.**

The advancing Malaspina glacier. By Prof. Ralph S. Tarr. [From *Science*, New York, January 4, 1907, pp. 34–37.] Size 10½ × 8. *Presented by the Author.*

See note in the April number, p. 460.

Alaska—Minerals. *B.U.S. Geol. Surv.* **277** (1906): pp. 80. **Moffit and Stone.**

Mineral resources of Kenai peninsula, Alaska. Gold fields of the Turnagain Arm region. By Fred H. Moffit. Coal fields of the Kachemak Bay region. By Ralph W. Stone. *With Maps and Illustrations.*

Alaska—Yakutat Bay. *B.G.S. Philadelphia* **5** (1907): 1–14. **Tarr.**

Second expedition to Yakutat bay, Alaska. By Ralph S. Tarr. *With Map and Illustrations.*

This expedition was carried out in the summer of 1906. Some of the results of that of 1905 were given in the *Journal*, vol. **28**, p. 30.

America—Ethnography. *Globus* **90** (1906): 287–289, 302–305. **Friederici.**

Die Ethnographie in den 'Documentos Inéditos del Archivo de Indias.' Von Dr. Georg Friederici. *Also separate copy, presented by the Author.*

Canada—Ethnology. **Hill-Tout.**

The native races of the British Empire. British North America. I. The Far West: the home of the Salish and Déné. By C. Hill-Tout. London: A. Constable & Co., 1907. Size 9 × 5½, pp. xiv. and 264. *Sketch-map and Illustrations. Price* 6*s. net. Presented by the Publishers.* [To be reviewed.]

Canada—Geological Survey. ———

Geological Survey of Canada. Annual Report (New Series), vol. xv., 1902–03. Ottawa, 1906. Size 9½ × 6½, pp. (1134). *Maps (separate), Illustrations, and Diagrams.*

Includes the summary reports for 1902 and 1903, a report on the Souris coal-field, and another on mineral production.

Mexico—Volcanoes. *Geological Mag.*, *Dec.* v., 4 (1907): 5–13. **Hobson.**

An excursion to the volcanoes of Nevado de Toluca and Jorulla in Mexico. By Bernard Hobson. *With Illustrations.*

North America—Niagara. **Spencer.**

Niagara Falls and Niagara district. By Dr. J. W. Spencer. (From the Summary Report of the Geological Survey Department of Canada, 1905.) Ottawa, 1906. Size 10 × 6½, pp. [5]. *Map. Presented by the Author.*

Noticed in the February number (p. 227).

United States—Appalachians. **Brigham.**

From trail to railway through the Appalachians. By Albert Perry Brigham. Boston and London: Ginn & Co., [1907]. Size 7¼ × 5, pp. viii. and 188. *Maps and Illustrations. Price 2s. 6d. Presented by the Publishers.*

An outcome of the laudable tendency lately noticeable in the United States to extend the teaching of geography, more than has been done in the past, from the physical framework to the human associations. The book traces the course of history with special reference to the highways of communication.

United States—California. *J. Geology* 15 (1907): 1–10. **Branner.**

A drainage peculiarity of the Santa Clara valley affecting fresh-water faunas. By J. C. Branner. *With Maps.*

United States—Eastern. **Smith and Halsey.**

A tour of four great rivers, the Hudson, Mohawk, Susquehanna, and Delaware, in 1769, being the journal of Richard Smith. Edited, with a short history of the pioneer settlements, by Francis W. Halsey. New York: Scribner's Sons, 1906. Size 9½ × 6½, pp. lxxiv. and 102. *Maps, Plans, and Illustrations. Price $5 net.*

Printed from a hitherto unpublished manuscript. The journal is valuable from the view it presents of old-time conditions in the valleys of the above-named rivers.

CENTRAL AND SOUTH AMERICA.

Argentine—Rio Negro. **Alemann.**

Am Rio Negro. Ein Zukunftsgebiet germanischer Niederlassung. Drei Reisen nach dem argentinischen Rio Negro Territorium. Ein Führer für Anseidler, Unternehmer und Kapitalisten von M. Alemann. Berlin: D. Reimer, 1907. Size 10 × 6½, pp. xvi. and 176. *Maps and Illustrations. Price 3s.*

Supplies useful information on the economic possibilities of a portion of the southern Argentine, mainly from the point of view of German settlement of the region.

Argentine and Chile—Volcanoes. *Rev. Museo La Plata* 11 (1904): 177–192. **Hauthal.**

Distribución de los centros volcánicos en la repúblioa Argentina y Chile. Por Rodolfo Hauthal. *With Map.*

Bolivia—Alpaca. ———

Ministerio de Colonización y Agricultura: Sección de Agricultura. Estudio sobre la crianza de la Alpaca en el país. Datos recopilados en cumplimiento de la Ley de 22 de noviembre de 1905. La Paz, 1906. Size 8½ × 5½, pp. 34 and xxxviii.

Brazil—Amazon. *Ann. de G.* 15 (1906): 449–462. **Cointe.**

Le climat amazonien, et plus spécialement le climat du bas Amazone. Par Paul Le Cointe.

Brazil—Ethnology. **Koch.**

Globus 89 (1906): 165–169, 309–316, 375–380; 90 (1906): 7–13, 104–111, 117–124, 261–268, 325–329, 345–351.

Kreuz und quer durch Nordbrasilien. Von Dr. Theodor Koch-Grünberg. *With Map and Illustrations.*

Short accounts of Dr. Koch's travels were given in vol. 26, p. 89, and 27, p. 505. The present series of articles is largely concerned with ethnology, and includes many photographs of the natives.

Brazil—Pernambuco. **Carvalho.**

Alfredo de Carvalho. Estudos Pernambucanos. Recife, 1907. Size 7½ × 4½, pp. 352. *Price $3. Presented by the Author.*

Miscellaneous studies, chiefly historical. One deals with Dutch explorations in the seventeenth century in search of precious metals.

Brazil—São Paulo. ———

Commissão Geographica e Geologica do Estado de S. Paulo. Exploração dos rios Feio e Aguapehy (Extremo sertão do Estado), 1905. São Paulo, 1906. Size 17½ × 13, pp. 26. *Maps and Illustrations.*

Chile—Geology. *Quart. J. Geol. S.* **63** (1907): 64–68. **Evans.**

Notes on the raised beaches of Taltal (Northern Chile). By Oswald Hardey Evans.

Chile-Argentine Boundary. **Donoso.**

Republica de Chile: Oficina de Limites. Demarcacion de la linea de frontera en la parte sur del territorio. Trabajos de la quinta sub-comision chilena de limites con la República Arjentina. [Por] Alvaro Donoso G. Santiago, 1906. Size 11 × 7½, pp. xxxvi. and 192. *Maps, Illustrations, and Diagrams.*

Panama—Canal. **Johnson.**

Four Centuries of the Panama Canal. By Willis Fletcher Johnson. London, etc.: Cassell & Co., 1907. Size 8¾ × 5½, pp. xxii. and 462. *Maps, Portraits, and Illustrations. Price 12s. net. Presented by the Publishers.*

AUSTRALASIA AND PACIFIC ISLANDS.

Caroline Islands. *Globus* **90** (1906): 279–283. **Senfft.**

Die Bewohner der Westkarolinen. Von Arno Senfft. *With Illustrations.*

Marshall Islands. *Petermanns M.* **52** (1906): 270–277. **Jeschke.**

Bericht über die Marshall-Inseln. Von Kapitän C. Jeschke.

New Guinea—Dutch. **Hellwig.**

Ts. K. Nederlandsch Aardrijksk. Genoots. **24** (1907): 63–67.

Een landtocht naar den bovenloop der Koembĕ-River (z. Nieuw-Guinea) van Mĕraukĕ uit, in Aug. 1906. Door R. L. A. Hellwig.

The Koembe is the river previously known as the Amerauke.

New South Wales—Fisheries. ———

Fisheries of New South Wales: Report of Board for the year 1905. (Sydney, 1906.) Size 13 × 8½, pp. 74. *Presented by the Dept. of Fisheries, N.S.W.*

Pacific—Trade Routes. *Ann. der Hydrographie* **35** (1907): 53–64. **Knipping.**

Die Dampferwege zwischen Yokohama und Portland, Oregon. Von E. Knipping. *With Diagrams.*

Polynesia. **Grimshaw.**

From Fiji to the Cannibal Islands. By Beatrice Grimshaw. London: Eveleigh Nash, 1907. Size 9 × 6, pp. xii. and 356. *Illustrations.*

Queensland—Water-supply. *P.R.S. Queensland* **19** (1906): 105–132. **Wasteneys.**

Description of a typical Queensland lagoon (the Enoggera reservoir, near Brisbane), with methods of rendering the water fit for a town supply. By Hardolph Wasteneys.

Samoa—Savaii. *M. k.k. G. Ges. Wien* **49** (1906): 566–585. **Bauer.**

Eine Reise auf der Insel Sawaii (Samoa). Von Dr. Viktor Ritter v. Bauer.

Samoa—Savaii. *Petermanns M.* **52** (1906): 277–279. **Reinecke.**

Der Vulkanismus Savaiis (Samoa). Von Dr. T. Reinecke.

Samoa—Savaii. *Z. Ges. E. Berlin* (1906): 686–709. **Sapper.**

Der Matavanu-Ausbruch auf Savaii 1905–06. Nach Aufzeichnungen von Pater Meunel, Metteilungen von Dr. B. Funk und gedruckten Berichten dargestellt von Prof. Dr. Karl Sapper. *With Map and Illustrations.*

POLAR REGIONS.

Antarctic—Zoology. **Charcot and Others.**

Expédition antarctique française (1903–1905), commandée par le Dr. Jean Charcot. Sciences naturelles: Documents scientifiques. Crustacés, par H. Coutière, Harriett Richardson, Ed. Chevreux, et A. Quidor (pp. 10, 24, 100. and 20). Mollusques, par A. Vayssière, L. Joubin, Ed. Lamy, et le Dr. Joh. Thiele (pp. 52, 14, 20, and 4). Echinodermes, par R. Koehler et C. Vaney (pp. 42 and 30). Tuniciers, par Sluiter (pp. 50). Poissons, par Léon Vaillant (pp. 52). Hydroïdes, par Armand Billard (pp. 20). Paris: Masson et Cie., [1906]. Size 11 × 9. *Map and Plates. Presented by the Ministre de l'Instruction Publique, etc.*

Antarctic—Zoology. **[Wilson and Others.]**

National Antarctic Expedition, 1901-1904. Natural History. Vol. 2, Zoology (Vertebrata, Mollusca, Crustacea). Vol. 3, Zoology and Botany (Invertebrata, Marine Algæ, Musci). London, 1907. Size 12½ × 9½, pp. (vol. 2) xiv. and (362); (vol. 3) vi. and (280). *Map, Plates, and Illustrations. Price* 60*s.* and 50*s. Presented by the British Museum (Natural History).*

The bulk of vol. 2 is made up by Dr. Wilson's report on the mammals and birds. The other collections are described by a number of specialists.

Arctic—Spitsbergen. **Nathorst.**

Svenskarnes arbeten på Spetsbergen (1758, 1837, 1858–1902). Af A. G. Nathorst. (From the *Nordisk Tidskrift*, Stockholm, 1906; Sjunde häftet.) Size 10 × 6½, pp. 461–477. *Maps and Illustrations. Presented by the Author.*

A summary of Swedish work in Spitsbergen, principally since 1858.

Arctic Ocean. **Orléans.**

A travers la Banquise, du Spitzberg au Cap Philippe, Mai-Août, 1905. Par le Duc d'Orléans. Paris: Plon-Nourrit & Cie., 1907. Size 11 × 7½, pp. 352. *Maps and Illustrations. Price* 20 *fr. Presented by the Publishers.* [To be reviewed.]

Polar—Congress. *B.S.R. Belge G.* **30** (1906): 325–380. **Rahir.**

Le Congrès international pour l'étude des régions polaires. Par Rahir.

MATHEMATICAL GEOGRAPHY.

Astronomy—Star Catalogue. **Ambronn.**

Sternverzeichnis, enthaltend alle Sterne bis zur 6.5ten Grösse fur das Jahr 1900, bearbeitet auf Grund der genauen Kataloge und zusammengestellt von J. und R. Ambronn, mit einem erläuternden Vorwort versehen und herausgegeben von Dr. L. Ambronn. Berlin: J. Springer, 1907. Size 11 × 7½, pp. xii. and 184. *Price* 10*s.*

Most conveniently arranged for the purposes of explorers, with whose requirements the editor is thoroughly familiar by long association with their work.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Climatology. **Shaw.**

The Royal Sanitary Institute Congress at Bristol, 1906. Climate and Health. Address by Dr. W. N. Shaw. Section iii. (Excerpt from vol. **27**, No. 10 (1906) of the *Journal of the Royal Sanitary Inst.*) London, 1906. Size 10½ × 7, pp. 517–530. *Maps and Diagrams. Presented by the Author.*

Geomorphology—Earth and Moon. *J. Geology* **15** (1907): 23–38. **Pickering.**

The place of origin of the moon—the volcanic problem. By William H. Pickering. *With Maps.*

Noticed in the May number (p. 576).

Glaciers. *La G., B.S.G. Paris* **14** (1906): 261–274. **Kilian.**

L'érosion glaciaire et la formation des terrasses. Par W. Kilian. *With Sections and Illustration.*

Hydrology. *M. k.k. G. Ges. Wien.* **49** (1906): 523–565. **Kastner.**

Einfluss offener Gewässer auf das Grundwasser. Von Prof. Karl Kastner. *With Diagrams.*

See note in the June number (p. 679).

Hydrology. *U.S. Geol. Surv., Water Supply Papers* **155** (1906): pp. 84. **Veatch.**

Fluctuations of the water-level in wells, with special reference to Long Island, New York. By A. C. Veatch. *With Maps, Sections, and Diagrams.*

Ice. *Monthly Weather Rev.* **34** (1906): 465–467. **Barnes.**

On the formation of anchor ice, or ground ice, at the bottom of running water By Dr. H. T. Barnes.

Magnetism—Historical. **Thompson.**

Petrus Peregrinus de Maricourt and his Epistola de Magnete. By Silvanus P. Thompson. (From the *Proceedings of the British Academy*, vol. 2.) London: H.

Frowde, [*not dated;* 1906]. Size 10 × 6, pp. 32. *Plate and Diagrams. Price* 2*s. net. Presented by the Publisher.*

A paper read before the British Academy in November, 1906. Prof. Thompson is perhaps the best authority living on the early history of magnetism, and he here supplies an excellent sketch of the part played by Petrus Peregrinus in this connection.

Meteorology—Air Currents. *P. American A.* **42** (1906): 261–272. **Rotch.**
Results of the Franco-American expedition to explore the atmosphere in the Tropics. By A. Lawrence Rotch.

Meteorology—Methods. **Hellmann and Hildebrandsson.**
Internationaler Meteorologischer Kodex. Im Auftrage des Internationalen Meteorologischen Komitees bearbeitet von G. Hellmann und H. H. Hildebrandsson. Berlin, 1907. Size 11 × 7½, pp. viii. and 82.

Embodies the decisions of the International Meteorological Congresses from 1872 onwards, with the necessary explanations, etc.

Phytogeography. **Henslow.**
Introduction to plant-ecology, for the use of teachers and students. By Rev. Prof. G. Henslow. London: E. Stanford, 1907. Size 7 × 5, pp. x. and 130. *Price* 2*s.* 6*d. Presented by the Publisher.*

This little book should do much to encourage the fascinating study of plant-ecology, or the relations of plant-life to the conditions of its habitat.

Zoogeography—Mosquitoes. **Theobald.**
A monograph of the *Culicidæ*, or mosquitoes. Mainly compiled from collections received at the British Museum. By Fred V. Theobold. Vol. 4. London, 1907. Size 8½ × 5½, pp. xx. and 640. *Illustrations. Price* 32*s.* 6*d. Presented by the British Museum (Natural History).*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography. *Petermanns M.* **52** (1906): 241–251, 265–270. **Woeikow.**
Verteilung der Bevölkerung auf der Erde unter dem Einfluss ner Naturverhältnisse und der menschlichen Tätigkeit. Von Prof. Dr. A. Woeikow. *With Maps.*

Anthropogeography—Climate and Health. ———
British Association Committee for the investigation of the effect of climate on health and disease. Memorandum on the climatic and other geographical data for the investigation. Size 10 × 8, pp. 6.

Colonization. *Z. Kolonialpolitik* **9** (1907): 19–51. **Halle.**
Die grossen Epochen der neuzeitlichen Kolonialgeschichte. Von Prof. Dr. E. von Halle.

Commercial—Bananas. **Hubert.**
Bibliothèque pratique du colon. Le bananier. Par Paul Hubert. Paris: H. Dunod et E. Pinat, 1907. Size 8 × 5, pp. x. and 222. *Illustrations. Price* 5 *fr.*

A concise monograph on the geographical distribution and economic uses of the various species of *Musa*, including that which supplies the Manila hemp of commerce.

Ethnology—Culture. **Balch.**
Comparative Art. By Edwin Swift Balch. Philadelphia: Allen, Lane, & Scott, 1906. Size 11 × 7½, pp. 212. *Presented by the Author.*

Ethnology—Negritos, etc. *Globus* **91** (1907): 8–14, 21–26, 37–44. **Fritsch.**
Ueber die Verbreitung der östlichen Urbevölkerungen und ihre Beziehungen zu den Wandervölkern. Von Gustav Fritsch. *With Illustrations.*

Historical Geography. *Deutsche Erde* **5** (1906): 207–213. **Koblischke.**
Die Ortsnamenforschung als Unterlage historischer Nationalitätenforschung. Von Julius Koblischke.

Historical—Cartography. *Annalen Hydrographie* **34** (1906): 516–527. **Behrmann.**
Die Entstehung nautischer Kartenwerke Niederdeutschlands und ihr Einfluss auf die Kartographie. Von Dr. Walter Behrmann. *With Facsimile Maps.*

Historical—Charts. *Riv. G. Italiana* 13 (1906): 618–621. **Crinó.**

A proposito di due Carte di Navigare, che si trovano nella libreria del generale I. Pescetto. Del Prof. Sebastiano Crinó.

These charts are without author's name, but seem to date from the second half of the sixteenth century. One embraces the coast of Western Europe and North-West Africa, the other the Ægean and neighbouring coasts.

Historical—Travels. **Smith.**

The Generall Historie of Virginia, New England, and the Summer Isles. Together with the True Travels, Adventures and Observations, and A Sea Grammar. By Captain John Smith. 2 vols. Glasgow: J. MacLehose & Sons, 1907. Size 9 × 6, pp. (vol. **1**) xxxiv. and 396; (vol. **2**) xx. and 330. *Facsimile Maps and Illustrations. Price* 25*s. net. Presented by the Publishers.*

Historical—Villani. **Bellio.**

Vittore Bellio. Le cognizioni geografiche di Giovanni Villani. 2 parts. Rome, 1903–1906. Size 9 × 6½, pp. 114 and 44. *Maps.*

The first part forms a dictionary of all the place-names mentioned by Villani in his historical works (fourteenth century). In the second, the author discusses Villani's geographical knowledge.

Historical—Voyages. **Dampier and Masefield.**

Dampier's Voyages, consisting of a New Voyage round the World, a Supplement to the Voyage round the World, Two Voyages to Campeachy, a Discourse of Winds, a Voyage to New Holland, and a Vindication, in answer to the Chimerical Relation of William Funnell. By Captain William Dampier, edited by John Masefield. 2 vols. London: E. Grant Richards, 1906. Size 9 × 5½, pp. (vol. **1**) x. and 612; (vol. **2**) viii. and 624. *Facsimile Maps, Portrait, and Illustrations. Price* 25*s. net.*

Language. **Millard.**

L'Arabe parlé (Spoken-Arabic). Dictionnaire-Grammaire en lettres françaises (adapted into English). Par Bruce Millard. Paris: Garnier Frères; London: Dulau & Co., [1905]. Size 7 × 5, pp. x. and 164. *Presented by Messrs. Dulau & Co.*

Medical Geography. **Weber.**

Climatotherapy and Balneotherapy: the climates and mineral water health resorts (spas) of Europe and North Africa, including the general principles of climatotherapy and balneotherapy, and hints as to the employment of various physical and dietetic methods. By Sir Francis Weber and F. Parkes Weber. London: Smith, Elder, & Co., 1907. Size 10 × 6, pp. 834. *Price* 15*s. net. Presented by the Publishers.*

Military Geography. **May.**

Geography in relation to war. By Colonel E. S. May. London: H. Rees, Ltd. Size 8½ × 5½, pp. 62. *Maps and Plan. Price* 2*s. net. Presented by the Publishers.*

GENERAL.

Bibliography. **Baschin.**

Bibliotheca geographica. Jahresbibliographie der gesamten geographischen Literatur. Herausgegeben von der Gesellschaft für Erdkunde zu Berlin. Bearbeitet von Otto Baschin. Band xii. Jahrgang 1903. Berlin: W. H. Kühl, 1907. Size 9 × 6, pp. xvi. and 518. *Presented by the Gesellschaft für Erdkunde zu Berlin.*

This volume has succeeded its predecessor with praiseworthy speed, giving hopes that future volumes may appear still nearer the date to which they refer.

Educational. **L'Estrange.**

A junior course of comparative geography, consisting of course "A" of "A progressive course of comparative geography." By P. H. L'Estrange. London: G. Philip & Son, 1907. Size 8½ × 5, pp. viii. and 240. *Maps and Illustrations. Presented by the Publishers.*

See review of the larger work in the May number (p. 560).

Geographical Terms. **Hochsteyn.**

Lucien Hochsteyn. Les termes de la géographie dans les langues du globe. Brussels: Misch et Thron, 1907. Size 11 × 7½. *Price* 10 *fr.*

The author has devoted an immense amount of labour to the task of collecting the equivalents of French geographical terms in a large number of different languages, but in certain directions the book leaves a good deal to be desired, both on the score of omissions and insufficient nicety of definition.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from June 1 to 30, 1907.

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In outline, sheets 80, 109, 187, 188, 191, 351. 1*s. each* (engraved).

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England and Wales. **Geological Survey.**

1-inch—New Series. Colour printed. Worms Head, 246. Solid and Drift editions. 1*s.* 6*d. each.*

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(*E. Stanford, London Agent.*)

Portugal. **Direcção Geral dos Trabalhos Geodesicos, Lisbon.**

Carta de Portugal. Scale 1 : 50,000 or 1·3 inch to 1 stat. mile. Sheets: C—8, 9, 10, and 17. Lisbon: Direcção Geral dos Trabalhos Geodesicos e Topographicos, 1900–1904.

Sweden. **Generalstaben, Stockholm.**

General Karta öfver Sverige. Utgifven af Generalstaben. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. Stockholm: Generalstabens Litografiska Anstalt, 1906. *Presented by Baron E. G. E. Leijonhuvud.*

Sweden. **Generalstabens Topografiska Afdelning, Stockholm.**

Karta öfver Sverige. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets: 68, Sollefteå, N.O., S.O., S.V., 1905–1906.—Karta öfver Norrbottens Lan. Scale 1 : 200,000. Sheets: 45, Rödkallen, 1903; 46, Frostviken, 1903; 51, Skellefteå, 1906; 52, Munsfjället, 1904; 53, Alanäs, 1906; 58, Kolåsen, 1905; 65, Dufed, 1904; 66, Åre, 1903; 67, Östersund, 1903.—Höjdkarta öfver södra och mellersta

Sverige. Scale 1 : 500,000 or 1 inch to 7·8 stat. miles. Sheet VI.—Höjdkarta öfver norra Sverige. Scale 1 : 500,000 or 1 inch to 7·8 stat. miles. Sheets IV. and V. Stockholm: Generalstabens Topografiska Afdelning. *Presented by the Swedish Topographical Survey.*

ASIA.

Asia Minor. **Kiepert.**

Karte von Kleinasien. Bearbeitet von Dr. Richard Kiepert. Scale 1 : 400,000 or 1 inch to 6·3 stat. miles. Sheet B II.—Brussa. Berlin: Dietrich Reimer (Ernst Vohsen), 1907. *Price 6m. each sheet.*

This excellent map is fast drawing to completion, only two more sheets now remaining to be published. The area of the present sheet extends approximately from 39° to 40° 45′ N. lat., and from 28° 10′ to 31° E. long.

Dutch East Indies. **Stemfoort and Siethoff.**

Atlas der Nederlandsche Bezittingen in Oost-Indië, naar de neiws Cronnen samengesteld en aan de regeering opgedrägen door J. W. Stemfoort en J. J. ten Siethoff, Kapiteins van den Generalen Staf van het Nederlandsch-Indisch leger. Gereproduceerd, op last van het Department van Koloniën, aan de Topographische Inrichting te 's Gravenhage, onder leiding van le Directeur C. A. Eckstein. Sheet 4 (new edition), Midden-Java. Scale 1 : 500,000 or 1 inch to 7·9 stat. miles. The Hague: Topographische Inrichting, 1907.

A sheet of a good general map of Java, printed in colours, and forming part of the large official Dutch Colonial Atlas. It extends from Cheribon on the west to Kediri on the east, and contains as an inset a plan of Semarang on the scale of 1 : 50,000, which place falls in about the centre of the sheet.

Malay Peninsula. **Revenue Survey, Taiping.**

Compiled plan of the Federated Malay States. Scale 1 : 760,320 or 1 inch to 12 stat. miles. Taiping: Revenue Survey Office, 1907. *Presented by J. P. Harper, Esq., Superintendent of Revenue Surveys, Perak.*

A small general map including Perak, Wellesley Province and Palau Pinang, Dindings, Pahang, Selangor, and Negri Sembilan. Although containing little detail, it will be useful as showing roads up to date, which are clearly given. The map is printed in colour.

AMERICA.

Brazil. **Maia.**

Mappa da Viação Ferrea de São Paulo mostrando a Zona tributaria da E. F. Sorocabana. Organisado sob a superintendencia do Engenheiro Alfredo Maia. Scale 1 : 2,000,000 or 1 inch to 31·5 stat. miles. São Paulo: Secretaria de Agricultura do Estado de São Paula, 1907. *Presented by Sr. Frederico H. Sawyer, Directoria de Industria e commercio.*

Showing railways under construction and proposed in the state of São Paulo, Brazil. The map includes a larger area than this state, and reaches as far west as Bolivia and Paraguay. The extent to which the rivers are navigable is clearly shown. It is but a mere outline sketch, drawn for the special purpose indicated.

Canada. **Dept. of the Interior, Ottawa.**

Sectional map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheets: 15, Lethbridge, revised to April 8, 1907; 313, Brule, revised to April 6, 1907. Ottawa: Dept. of the Interior, Topographical Surveys Branch, 1907. *Presented by the Department of the Interior, Ottawa.*

Ecuador. **Galindo.**

Mapa geográfico-histórico de la Republica del Ecuador. Por el R. P. Fray Enrique Vacas Galindo de la Orden de Predicadores. Scale 1 : 1,500,000 or 1 inch to 32·7 stat. miles. Four sheets. Quito: Ministerio de Instruccion Publica y de Hacienda, 1906.

The claim this map has to be considered "historical" lies in the fact that it shows by various coloured lines and symbols the boundaries of Ecuador according to treaties and agreements from early dates, as interpreted in that republic, and according to the claims set up at various times by the neighbouring republics. Geographically, the map exhibits, in a somewhat rough and diagrammatic manner, the general relief and river systems, and gives the location of the many Indian tribes between the Andes and the upper waters of the Amazon. In this latter respect it

has a special value, as much of this information is from the author's personal knowledge. As a cartographical production the map is decidedly inferior to Wolf's large map, which has been utilized in its preparation. The limit of steamer navigation on the rivers is shown, and railways projected and working are indicated. A list of authorities consulted is given as a note on the map.

GENERAL.

World. **Bludau and Handtke.**

Neue zeitgemässe Bearbeitung von Sohr-Berghaus Hand-Atlas über alle Teile der Erde. Entworfen und unter Mitwirkung von Otto Herkt herausgegeben von Professor Dr. Alois Bludau. Früher herausgegeben von F. Handtke. Neunte Auflage. Lieferung 10. Nos. 49, Italien, Blatt 3; 78, Südamerika (Uebersicht); 9, Deutsches Reich und Niederland (Physisch). Glogau: Carl Flemming, [1907]. *Price* 1*m*. *each part.*

These are three sheets of a new edition of this cheap popular German atlas. In the two physical maps of the German Empire and South America the highlands are tinted bright carmine, giving an unnecessarily abrupt change from the lower levels.

World. **Harmsworth.**

Harmsworth Atlas and Gazetteer. 500 maps and diagrams, and 105,000 references. Parts 17 and 18. London: The Amalgamated Press, Ltd., 1907. *Price* 7*d*. *each part.*

These parts contain the following maps: Part 17, Nos. 51–52, Belgium and Luxemburg; 107–108, Modern Palestine and Sinai Peninsula; 179–180, West Indies (industries and communications). Part 18, Nos. 57–58, Western Germany; 73–74, Spain and Portugal (industries and communications); 157–158, Canada.

World. **St. Martin and Schrader.**

Atlas Universel de Géographie construit d'après les sources originales et les documents les plus récents, cartes, voyages, mémoires, travaux géodésiques, etc., avec un texte analytique. Ouvrage commencé par M. Vivien de Saint-Martin et continué par Fr. Schrader. Sheet No. 51, Perse, Afghanistan et Inde Nord-Ouest. Paris: Hachette et Cie., 1907.

This forms part of the ten-sheet map of Asia which is being specially drawn and engraved for this atlas, and is the fifth sheet of the map to be published up to date. Like the others, it has been extremely well executed. The area includes Persia, Afghanistan, Baluchistan, Bokhara, North-West India, and the Arabian shores of the Persian gulf. Accompanying the sheet is a list of the authorities consulted in its compilation.

Charts.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during May, 1907. *Presented by the Hydrographer, Admiralty.*

New Charts.

No.	Inches.	
3638 m	= 5·0	France, south coast: Golfe de Fréjus and Rade d'Agay. 3*s*.
2487 m	= 3·6	United States, east coast: Portsmouth harbour. 2*s*.
3659 m	= var.	South America. Ports in Magellan strait:—Canal Condor and Lago de la Botella, Puerto Condor, Puerto Toro, Port Valderrama, Puerto Pomar. 2*s*.
3651 m	= 3·6	Chile. Plans in the Guaitecas islands:—Port Barrientos, Port Low, Port Melinka. 2*s*.
3626 m	= 2·5	Borneo:—Dumpil point to Gaya head, including Gaya island. 3*s*.
3616 m	= 0·1	Celebes:—Tomori gulf to Salayar strait, including Buton strait and gulf of Boni. 3*s*.
1968 m	= 0·1	China, east coast:—Formosa island and strait. 3*s*.
1258 m	= 0·3	Korea, west coast: Approaches to Seoul, including Techong (Sir James Hall) group. 4*s*.
1969 m	= {1·5, 4·9}	Japan: Ozuchi jima to Funoko sima. Plans:—Uno wan, Takamatsu ko. 3*s*.
3629 m	= 0·11	New Zealand:—Hokitika to Otago harbour, including Cook strait. 3*s*.

Urema plain, Gorongoza; (15) Hyena bitch, Urema plain; (16) Hippopotamus' head, Urema plain; (17) Gathering in a hippopotamus, Urema plain; (18) Hippopotamus bull, Urema plain; (19) Impala ram; (20) Impala ram, near Somenyei's, on the Vinduzi river; (21) Carrying in a lion, Urema plain; (22–24) Lion, Urema plain; (25 and 26) Lion's head, Urema plain; (27) Male and female Dribi, near Seende, Gorongoza; (28) Reedbuck ram, near Seende; (29) Reedbuck ram, near Mapanda's; (30) Sable antelope cow, near Mapanda's; (31) Wharthog sow, Urema plain; (32) Cutting up a wildebeeste, Urema plain; (33) Wildebeeste bull, Urema plain; (34) Water-buck with one horn, Urema plain; (35) Wharthog head, near Mombez, Gorongoza; (36) Zebra, Mombez; (37) Water-buck, near Mombez; (38) Native huts at Mapanda's village; (39) Mapanda's residence; (40) Boys at meal-time; (41) Ducks and geese on the Sungwe, Urema plain; (42) Mob of elephant crossing the Uremi plain; (44) Mob of wildbeeste on the Urema plain; (45) Mob of zebra on the edge of the Urema plain; (46) The "Maskaji Sungwe," on the Urema plain; (47) The Urema plain, looking towards the Sungwe; (48) Baobab tree; (49) Burning the grass on the Urema plain; (50) Boy and fish-trap in one of the channels draining the Urema plain; (51) Beira from the sea; (52) The start of the trip from Beira; (53) The junction of the Pungwe and Madingue Dingue rivers; (54) The mouth of the Urema river; (55) A hippo pool on the Vinduzi river; (56) A hippo pool on the Vinduzi river and Mount Bungo; (57) Looking south-east from the top of Mount Bungo; (58) Crossing the Urema river at Bombah; (59) The Yadouhi river; (60) A shooting party on the Urema plain; (61) Crossing the Urema plain in Machillas; (62) The headquarters of the Gorongoza Company; (63–70) Nine lions and one leopard, shot by Mr. H. W. Reid; (71) Mr. H. W. Reid.

Spain. **Sternberg.**

Sixty-six photographs of Spain, taken by F. Sternberg, Esq. *Presented by F. Sternberg, Esq.*

These photographs were taken by Mr. Sternberg during a recent tour in Spain. Although perhaps more historical than geographical, many of them are of considerable interest.

(1) Bridge at Ronda; (2) Curious inverted arch at Ronda. Granada:—(3) El Generalife; (4) Lion's court, Alhambra; (5) Interior of court at the Alhambra, and arch; (6) Arch at Alhambra; (7) Palace of Ferdinand and Isabella. Seville:—(8) The cathedral; (9) Entrance to the orange court at cathedral; (10) Torre de Oro, with cathedral in distance; (11) Man and donkey; (12) Calle Sierpes. Cordova:—(13) Tower of cathedral; (14) Interior of cathedral; (15) Entrance to courtyard of cathedral; (16) Children in Orange court at cathedral; (17) Entrance to house of Geronimo Paez; (18) Bridge; (19) Puerta de la Verdad; (20) Tower at the end of the bridge opposite the city. Toledo:—(21) Alcantara bridge; (22) San Martin bridge; (23) Church of San Juan de los Reyes. Madrid:—(24 and 25) The Puerta del Sol; (26) The Royal palace; (27) Street-hawker with imitation ironclad; (28) El Escorial; (29) City of Avila, showing old walls. Segovia:—(30) The cathedral; (31) Part of the cathedral from the Plaza; (32 and 33) The walls of Segovia; (34) View of Segovia, showing aqueduct; (35) Aqueduct, and snow-capped mountains behind; (36) Old Segovia; (37) Segovia and snow-capped mountains; (38) Convent, El Parral; (39) El Alcazar; (40) The aqueduct; (41) Casa de los Picos; (42) Plaza de la Constitucion; (43) Puerta de Madrid; (44) Puerta de San Cebian and walls; (45) Patio in palace of the Marquis Arco. Burgos:—(46) View of Burgos and cathedral from the castle; (46*a*) Principal entrance to cathedral; (47) A bit of the cathedral; (48) Entrance to Pellejeria cathedral; (49) The cloisters, Pellejeria cathedral; (50) Interior of Burgos cathedral, showing processional chariot; (51) Bishop's palace; (52) Arms of the Cid; (53) Plaza mayor; (54) Old house; (55) Casa de Miranda; (56) Arco de Santa Maria; (58) Las Huelgas convent; (59 and 60) Las Huelgas convent church; (61) Graves of British soldiers who fell before San Sebastian in 1836 whilst fighting against the Carlists. Fuenterrabia:—(62) General view of Fuenterrabia; (63) Calle mayor; (64) Calle Pampinot; (65) Calle de Lastiendas; (66) The town gate.

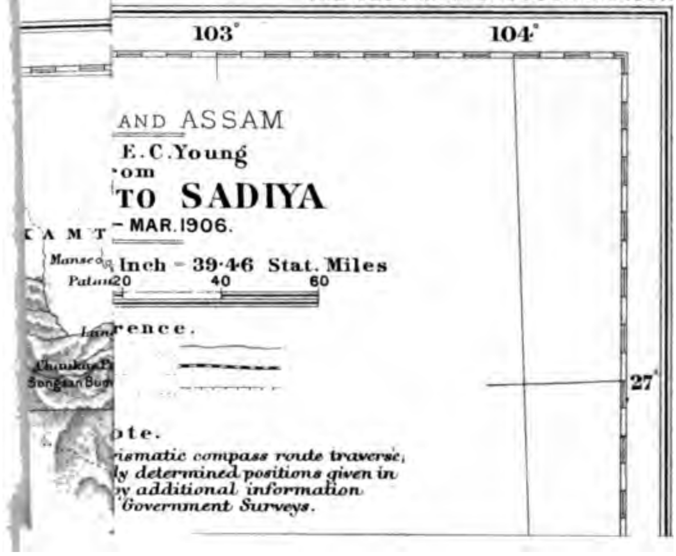
N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

CENTRAL AFRICA.
Alexander.

THE GEOGRAPHICAL JOURNAL 1907.

YUN-NAN AND ASSAM.
Young.

THE GEOGRAPHICAL JOURNAL 1907.



New Plans and Plans added.

No.	Inches.	
2116 m	= {5·0, 10·2}	Denmark, Little Belt. Plans added :—Aarhus harbour, Svendborg harbour. 4s.
158 m	= 2·4	Italy, chart II. Cape Cavallo to Civita Vecchia and adjacent islands. Plan added :—Talamone bay. 3s.
930 m	= 3·9	Plans of anchorages between Borneo and New Guinea. New plan :—Wahai and Hatiling bay. 2s.
3340 m	= 3·4	Gulf of Tartary, northern sheet. Plan added : Angevo road. 3s.
384 m	= 2·5	Plans in Tasmania. Plan added:—East bay and Blackman bay. 2s.
55 m	= 0·4	Anchorages in New Britain. New Ireland, and New Guinea. New plan :—Byron strait to Nusa harbour. 2s.

Charts Cancelled.

No.	Cancelled by	No.
2487 United States, east coast:—Portsmouth harbour.	New plan. Portsmouth harbour	2487
955 Borneo :—Lutut point to Gaya head, including Gaya and Sapangar bays.	New chart. Dumpil point to Gaya head, including Gaya island	3626
1968 China, east coast :—Formosa island and strait.	New chart. Formosa island and strait	1968
1258 Korea, west coast :—Approaches to Seoul, with Sir James Hall group.	New chart. Approaches to Seoul, including Techong (Sir James Hall) group	1258
1969 Japan :—Ozuchi sima to Funoko sima.	New chart. Ozuchi sima to Funoko sima. Plans: Uno wan, Takamatsu ko	1969

Charts that have received Important Corrections.

No. 1150, east coast, river Thames :—Erith to Broadness. 3466, Germany :—Wilhelmshaven. 3261, Germany, Elbe river :—Outer light-vessel to Brunsbuttelkoog. 3262, Germany, Elbe river :—Brunsbuttelkoog to Hamburg. 696, Germany: —Kiel harbour. 185, Germany :—Port Swinemünde and approaches to Stettin. 284, Newfoundland :—Cow head harbour to Ste. Geneviève bay. 2843a. United States, east coast:—Chesapeake bay, sheet I. 192, Gulf of Mexico:—Galveston entrance. 40, India, west coast: Karachi harbour. 2160, Carimata strait. 1342, Cochin China: Fan-rang bay to Tongking gulf. 775, Cochin China: Approaches to Haifong. 1741, Canton river, sheet II.

(*J. D. Potter, Agent.*)

Indian Ocean and Red Sea. **Meteorological Office.**

Monthly meteorological chart of the Indian Ocean north of 15° S. lat. and Red sea, July, 1907. London: Meteorological Office, 1907. *Price 6d. each. Presented by the Meteorological Office.*

North Atlantic. **U.S. Hydrographic Office.**

Pilot chart of the North Atlantic Ocean, June, 1907. Washington: U.S. Hydrographic Office, 1907. *Presented by the U.S. Hydrographic Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Monthly meteorological chart of the North Atlantic and Mediterranean, July, 1907. London: Meteorological Office, 1907. *Price 6d. each. Presented by the Meteorological Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot chart of the North Pacific Ocean, July, 1907. Washington: U.S. Hydrographic Office, 1907. *Presented by the U.S. Hydrographic Office.*

The

Geographical Journal.

No. 3. SEPTEMBER, 1907. VOL. XXX.

JOURNEYS IN NORTH MESOPOTAMIA.*

By MARK SYKES.

THE region which I hope to make more familiar to the readers of this *Journal* is one that, although to-day but little known, was in former ages a closely contested frontier which occupied the attention of the world for a longer period, perhaps, than any other in history, and it is a zone which to-morrow may engross the whole attention of Europe—I refer to that region which the classicist might call Mesopotamia, and which Arabs, in the present as in the past, term the Jazirah, or Peninsula. The Arab name is significant and useful, and although for the base purpose of engaging attention I have planned that the title should mention that blessed and soothing alternative, now that I have entrapped the reader I propose to avoid it, and make use only of that used by the Arabs.

The name Peninsula, or Jazirah, takes its rise from the fact that the region in which we are interested is almost surrounded and cut off, as it were, by two great rivers—the Tigris and the Euphrates—for the lands which lie between them are generally known by that name.

The general physical features of the Jazirah are simple in the extreme, and it will not take long to make a brief survey of them. To the north we have a fairly continuous range of mountains stretching in an unbroken line from Jezire-ibn Omar to the western slopes of the Karaja Dagh (a mountain which I might say until lately was represented as a solitary and stately peak, but has on later maps subsided into several of a more probable and less singular shape). Beyond the western slopes of the Karaja Dagh there is an apparent hiatus in this highland limit, which is in reality only an easing of the rising

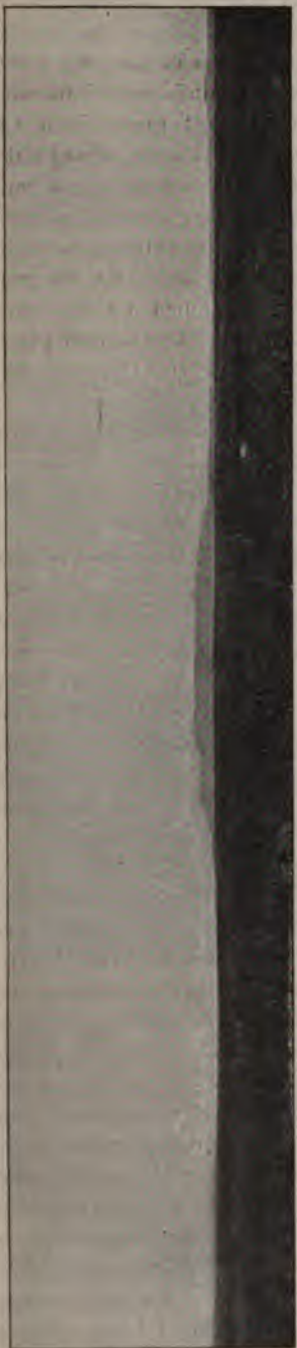
* Read at the Royal Geographical Society, March 11, 1907. Map, p. 356.

gradient from south to north, and is soon made good in the tumbled hills and mountains which stretch from Urfa to Birijik. This line of hill-country overlooks the lowlands of the Jazirah almost as the coast-line of a continent overlooks the ocean. In places, as between Mardin and Jezire-ibn Omar, the distinction is abrupt and decisive; the huge plains run up to the foot of the ascent, which at a distance of 10 or 12 miles suggests the likeness of an unbroken line of cliffs. The rising slopes of the Karaja Dagh group, on the other hand, merge gradually from the low country like some great island, and remind one faintly for a moment of a distant view of St. Vincent. The western continuation of the line, if we would follow the simile further, is much broken by bights, bays, and creeks, and presents a somewhat confused appearance.

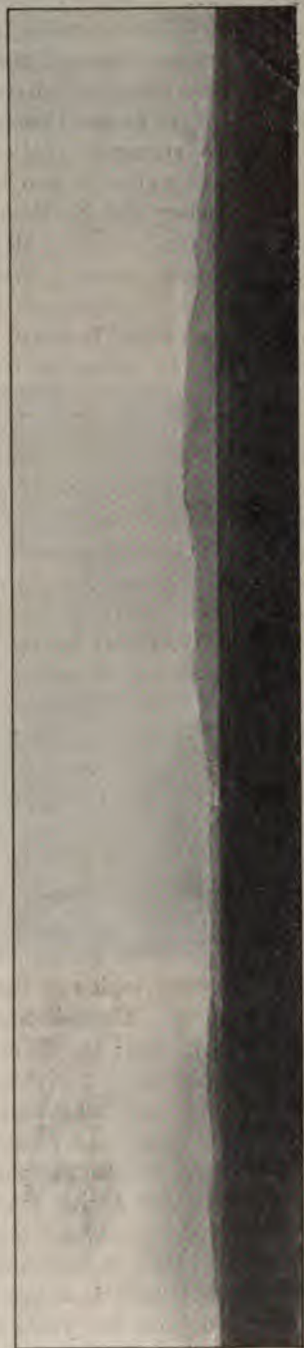
The second great feature of the Jazirah to which I would draw attention is the line of the Sinjar and Jebel abd-ul Aziz—two mountains which, save for one depression, form a continuous range some 125 miles in length. The singularity of these two ranges lies in their peculiar wall-like formation; in no place, I think, is either of them above 10 miles in breadth, nor does either possess any striking peak or summit; and though their actual tops are seemingly serrated with unremarkable projections, yet the general impression conveyed to the eye of the traveller, whether he views them from the north or south, is that of a vast earthwork, or an entrenchment of gigantic dimensions.

Having now described the mountains, we will turn to the river system. As will be seen from the map, both the Tigris and the Euphrates have one peculiarity in common; in both cases their more important affluents reach them from their left banks, consequently the Jazirah contributes nothing to the Tigris and all to the Euphrates. The interior waters of the Jazirah may be divided into two sections—the first flowing from the direction of Urfa, and ultimately, by the Belikh, passing into the Euphrates at Rakka; and the second the great Khabur river, with its various feeders, which take their rise at the foot of the Karaja Dagh and along the Mardin hills. The Belikh is a very peculiar waterway, and the fact that it is within reach of two such large towns as Urfa and Aleppo makes the fact that it is almost entirely unexplored very strange indeed. It is a deep, narrow stream some 30 feet wide and about 8 feet deep, with a moderate current, and, speaking generally, soft spongy banks. It takes its rise in the vicinity of Harran, where there are a good many springs, but its principal source of supply is at 'Ain el Arus, a spring and pool situated amidst low rolling hills.

'Ain el Arus is a famous shrine, and is the legendary site of the marriage and wedding festivities of the Prophet Abraham. In the centre of the pool is an abundant spring, filled with an enormous quantity of carp and fresh-water turtles; these creatures, together with the waterfowl which haunt the place, are looked on as sacred, and are



PANORAMA TAKEN AT KESRUKH.



CONTINUATION-PANORAMA TAKEN AT KESRUKH.

quite tame. If a man desires any particular wish, he is counselled to pray in the little mosque at 'Ain el Arus, give a present to Shaykh Saleh, who has charge of the shrine, and feed the fish in the pool. The fish are so tame, and have acquired so much confidence from this practice of pilgrims, that they will actually accept grain from the hand of a stranger. Between 'Ain el Arus and Rakka, the Belikh receives the waters of two tributaries: the Karamuk on the right bank a little below Tel el Hamam, and the Suluyuk on the left a little further north. At Tel el Hamam I discovered the ruins of a castle and a gigantic cistern; these remains, I think, may be said with some certainty to be those of Kelat Maslamah, mentioned by Mr. Guy L'Estrange in his 'Lands of the Eastern Kaliphate;' that author places it on his map (compiled from the *written* works of the Oriental geographers) not above a mile from the place where I found the ruins.

Mr. L'Estrange also marks the town of Bajerwan on the left bank of the Belikh, between Hamam and Ragga, in precisely the same spot on which I found the ruins of an extensive city. The banks of the Belikh are extremely fertile, and barley, maize, dura, rice, hemp, and opium can be cultivated on them with great success. I am unable to supply such detailed information concerning the Khabur as the Belikh, as I have never ridden down it, but have only crossed it at Ras el Ain and Shedadeh. At Ras el Ain it is a fair river about 40 feet wide and 3 feet deep; at Shedadeh, however, it had grown far greater, being unfordable, and, I should say, almost of the same proportions as the Thames at Maidenhead. Between Ras el Ain and Shedadeh the Khabur receives the waters of the Jag-Jag and the Girgan rivers, both strong perennial streams along which cultivation is possible, and, from the numerous ruins which stud their banks, I should imagine would prove profitable.

We must now consider the large areas of plain which lie betwixt these mountains and rivers. I will take them from west to east. The first section is that which lies between the Euphrates and the Belikh; this is a stony region of bare and forbidding hills, arid, repulsive, and uninteresting. There is one brief season when it is attractive, and that is in early spring; the following extract from my diary, written in the month of March, may give an imperfect impression :—

"The next morning we set out into the desert, or rather prairie, for that cannot be called a desert which the slightest scratch is sufficient to cultivate, and where the pasture is green for two months in the year. The lands of the Jazirah, indeed, differ from any other rolling stretches of country I have ever seen, and bear not the faintest resemblance to either the Texan or Mexican plains, nor the South African veldt. The atmosphere, which is at once clear and hazy, produces a very curious illusion—a stone 800 yards away appears to be close at hand, while a mountain on the horizon which is not more than 6 miles away appears

to be treble the distance; the two effects combined give an impression of a vastness and space that it is difficult to describe in words. The sky, which in spring is often cloudy and overcast, throws strange streaky shadows over the landscape, and a dull indefinite line of grey on the horizon will change suddenly to a clear bright ridge of yellow hills, which is equally quickly transmuted to a dark, forbidding range of purple mountains; the wadies form trailing serpents of olive-green and brilliant flowers; the rolling steppes run in lines of grey and green, thus marking the good grazing-land from the stony tracts. On the sky-line herds of camels move almost imperceptibly to and fro cropping the grass, while on the hillsides dappled flocks of sheep speckle the country with

MOSQUE AT 'AIN EL ARUS.

splashes of black and brown and yellow. The larks, while in the air, sing cheerily. Now and again a rare thunderstorm comes rushing across the land—a dark curtain of black, from which the huge falling drops smite the dusty ground, the hills and distant plains vanish, the horizon closes in, the ground turns yellow and red, the yellow lightning sends an unearthly sheen upon the grass, and for ten minutes we are in a strange unknown world of rushing waters, roaring wind, and rolling thunder. The storm passes over, the camels and sheep begin to move again, the larks are once more in voice, and, save for a little brightness in the sky, the desert is as it was before."

Once the line of the Belikh is reached, the scenery undergoes a

complete change; at all seasons the grass is green in its vicinity, and swamps and bogs are common. Between the Belikh and the Khabur we have another vast steppe of rolling hills, which, as one proceeds eastward, becomes more veldt-like and stony; the curious little conical hills, pimples as it were on the face of Nature, grow more frequent, and from convenient landmarks change into aggravating and perplexing distractions.

After crossing the Khabur we enter another and totally different description of the low country. From a land of low grassy wolds, where the view is always curtailed by a horizon of rolling undulations, we pass into a country where the visible distances are immense, and the natural features distinct and pronounced. Where we formerly looked eagerly for the sign of some slight hill or landmark, we stare blankly at the castle of Mardin, some 50 miles away, or at the snowy peaks of the Karaja Dagh, which hang, as it were, suspended in the air at nearly double that distance. Or if we turn south, the forbidding bulk of the Sinjar stands before us. Nor is it a flat and empty plain which is enclosed by these far-off barriers. Instead of empty wadis, we cross deep but narrow perennial streams, which thread their way through deep valleys, or alongside unending ranges of dark hills; while in place of the green grass we have grown so accustomed to, we ride over masses of flowers which dazzle the eye with their brilliancy and variegated colour, and whose honey scent is at times almost oppressive. I am sadly ignorant in botany, or I should attempt to give some account of them. As it is, I can only say that the hillsides are splashed with yellow, blue, and purple, while on the river-sides our horses could hardly force their way through the snowy banks of daisies and cowslips. And yet this well-watered country, whose fertility bursts out in this torrent of blossom, is almost uninhabited. As we proceed further east the magnificent and mysterious mountains of Kurdistan become visible, and the traveller finds himself in the centre of a vast horizon, of which this panorama gives some slight impression. The plain to the south of the Sinjar is another and wonderful change. Here we find an appalling flatness stretching mile upon mile, seemingly never destined to end.

Now, the question which naturally presents itself to one's mind is, What was the past of this strange and silent region? This is not the South African veldt with its miserable emptiness, or the Sahara with its dismal solitude; this land was once teeming with life and wealth, business and war. If we peer back into the darkest antiquity, we find a land densely peopled by a highly cultured race; mighty mounds still mark with permanence their fleeting sojourn, huge canals and dykes, some containing water even now, remain to show us where man once was. What was the precise nature of their civilization it would be almost impossible to say now; in a few years we may expect that archæological research will probably yield much minute but little general information

PIT AT TELL EL HAMAM (KALAT MASLAMAH).

WALLS OF BAKKA.

on that point; but this much we do know, that when Alexander appropriated the Persian Empire, the modern Jazirah contained many wealthy cities, that a large agricultural population flourished on the banks of the rivers to which I have just drawn attention, and, wonderfully enough, this prosperous population was never thoroughly disturbed amid all the changes of government and all the clashings and warrings that went on around it.

The empire of Alexander fades into Parthian and Seleucid dominion, the empires of the Macedonians are swallowed up into that of the great Republic, the dominion of the Parthians is changed to that of the Sassanian Persians, the Roman Empire of Augustus resolves itself into that of Constantine, and eventually the two ever-clashing forces of antiquity, Byzantium and Persis, are suddenly merged into one rule under the khalifs; yet through all these centuries and all these vicissitudes, read it as we will, the Jazirah seems to be ever the same. View it in the days of the triumvirate of Cæsar, Pompey, and Crassus. The rule for the nonce is Parthian, all along the Belikh there were great cities and isolated castles; along the Khabur the same; a fine town at Resaina, now Ras-al-Ain; in the north Nisibin and Dara, great flourishing and wealthy cities; Harran, a noted shrine enriched with costly gifts of devotees and worshippers; far to the south El Hadhr, another famous temple;—thus it always was along the rivers. And what of these great plains between them, dotted here and there, although it be but sparsely, with the remains of smaller towns? Personally, I am inclined to think, though if any one chooses to contradict I will not press the point, still I suggest that these great central plains were then, as now, inhabited by nomad shepherds. We know for certain that El Hadhr received its strength from the support of its affiliated desert tribes. May we not imagine, then, that these northern plains, where the tradition of Abraham * is still strong, were occupied also by shepherds, not wandering savages, but wealthy owners of the pastures? If this is not the case, how can the presence of the enormous army of cavalry of the Parthians which destroyed the army of Crassus be explained? How was it that during the winter the Romans could occupy such castles as they wished, and that, just as the pasture sprang up in spring, a huge army of cavalry suddenly congregated together, except by the fact that the shepherds deserted the middle plains in the winter and returned in spring as they do to this day?

It certainly suggests itself strongly to me that then, as now, the large plains between the rivers were occupied by a pastoral people, and that the river-banks only were settled. The presence of the ruins and mounds where there are springs of water and wells suggests that these

* Ain' el Arus and Hamam Ibrahim are still shrines of pilgrimage, and many Dervishes and holy men repair thither.

were either military stations, trading settlements,* wool depôts, and so on, whither the shepherds repaired to sell their produce and purchase commodities for themselves. Let us take a glance some three centuries later. Parthia is forgotten and dead; Persia is under the rule of Shapur; the Jazirah, which had been the battle-ground of East and West these three hundred years, seems, when Julian marched across it, to have been even as before. It was now practically entirely under Roman rule, and Julian and his army were able to march from Harran as far south as Rakka without needing a supply train, and when the broken army returned under Jovian from the south on the Tigris side, they found food and refreshment after passing the Sinjar in a land which is now

FACADE OF FRIDAY MOSQUE, RAKKA.

almost entirely empty. Another four centuries roll by. The Persian empire has breathed its last; that of Constantine, clipped and sheared of half its provinces, still survives; and the new power of the Moslems, the Eastern Khalifate, is in the full meridian of its glory at Baghdad.

Mr. Guy Lestrange, in a most admirable compilation, 'The Lands of the Eastern Caliphate,' gives a brief but striking account of the provinces of the Jazirah. Names have in many instances changed, whole cities have moved a league or so from their ancient sites, but the prosperity, the agriculture, the wealth, the teeming population remain. Then comes the rapid decline and disintegration of Arab dominion, and the commencement of the ruin of the prosperity of the Jazirah, long before

* Such as is Deir Zor to-day.

the Osmanli* power was heard of. Up to the present, although the Jazirah had almost continually formed a battle-ground, it had been the battle-ground of two great and wealthy empires, as Alexander and the Persians, the Seleucids of Antioch and their Eastern rivals, Rome and Parthia, Rome and Persia, Byzantium and the Caliphate. Consequently, no matter how the frontier had shifted, the land had always benefited to a certain extent from the advantage of having a government, whether European or Asiatic, which had the idea of extracting an income from the territory in question and no object in wasting it. However, in the twelfth century the whole aspect of affairs had entirely altered.

In 1174 we have a phantom khalif at Baghdad, independent kings of Mosul, Aleppo, Jezire-ibn Omar, Sinjar, and Erbil; while Edessa or Urfa, lately evacuated by the Franks, seems to have been left to look after itself—a collection of small incoherent and chaotic states governed by a motley array of Turkish and Arab adventurers, who continually raided and fought among themselves or wasted their substance in combating the never-ending wars of the crusades. It is not surprising that the opulent cities began to decline, that caravans became rarer and more infrequent, and the villages decreased in number. The country was ripe for a crushing blow, and Hulagu delivered it. The destruction of the Khalifate at Baghdad, the ruin of Syria by the Mongols, set the forces of rapid decline in motion; there was no imperial government to check, preserve, or save. Northern and Eastern Kurdistan, Irak, and Syria were all thrown into a state of hopeless and chaotic strife. The ancient canals were neglected, the people began apparently to migrate and flee, and Mesopotamia to assume its present appearance. The decline must have been slow but steady, for, as far as we can see, there was never any recrudescence of stable imperial power which is absolutely necessary for the development of prosperity in an Oriental country.

The small kingdoms and principalities jarred and jolted on through history like badly loaded, ill-driven waggons on a rough and dangerous road. Finally, we have the hideous vision of Timur sweeping in from the East. Such rags and tatters of wealth and cultivation as remained were now scattered by the armies of the destroyer, famine and massacre followed in his wake, and when, a couple of centuries later, the great Anatolian power of the Ottoman Empire reabsorbed the Jazirah into the Government of Byzantium, it was merely a pastoral tract that it annexed; and, indeed, the annexation was almost nominal, for even had the Turkish Government wished to administrate or improve the tracts they had wrested from Persia, they had neither the means nor the time. Victories, defeats, and politics on the western frontiers were then as great a hindrance to internal development as they are now. The

* I make note of this fact, because one is often led to suppose that the devastation and wreckage of centuries is entirely attributable to the tiny tribe of Osman.

question of how to find, pay, and equip an army for the conquest of Vienna affected the Asiatic provinces as keenly and as disastrously as do the ruthless and unscrupulous methods of the committeemen in Macedonia to-day. All that remained in the Jazirah were a few small towns at Rakka, Harran, Deir, Ana, Tell Afar, and Sinjar. Most of these were destroyed by the invasion of the Shammar Arabs, who broke in about that time and established Bedawin rule in the country and enslaved the surviving nomads.

I have now given a brief, imperfect, but general survey of the historic and physical aspect of the Jazirah; it now remains for me to give a more detailed view of its present condition. As in the past, the Jazirah is still a borderland—not a borderland between East and West, but a borderland between North and South; in fact, a borderland between the two elements in the population, which are respectively Arab and Kurd. In the Dersim mountains you will find the pure aboriginal and solitary Kurd, and in the desert you will find the Bedawin of the highest genealogy and the purest race. But between these two points you will find every variety of mixed people and a collection of tribes whose ethnological position is extremely confusing—a confusion which is rendered even more confounded when we come into touch with the Christian Jacobites of Tur Abdin and the devil worshippers of the Sinjar, for, owing to the Government system of grouping religions and sects into separate millets, and the efforts of the missionaries to introduce or foster among Christians what may be mistaken for a national spirit, we have a situation which for general complication and muddle is practically unrivalled.

The two great divisions are in fact the Arabs and the Kurds, the former predominating in the south, the latter in the north. The character of these two peoples is almost diametrically opposed, and is worth considerable attention. The pure Arab is a very strange being indeed. His mind is complex and cultured; there is no Arab of pure race to whom rhetoric, subtle argument, poetry, and histrionism do not appeal; he is able to take a broad view of matters, or to discuss reasonably on any subject within the range of his experience, and yet, when dealing with any material object, he seems almost a perverse dunderheaded clown. Work he loathes and abhors; his argumentative capacity provides him with an excuse; he announces that work is dishonourable and degrading. Consequently he avoids the point that he is incompetent, lazy, and incapable, and says that cultivating the ground, pitching a tent in a reasonable way, doctoring a horse, cooking food, building a house, are contemptible employments beneath the dignity of man, and leaves the baffled Western in the ridiculous position of a worthy but rather underbred person who has no finer instincts. However, although the Arab will not work, he has no scruples on the subject of money, before the attractiveness of which dignity, poetry, and the rest vanish like thin air.

The noblest and the basest Arabs are at one on this subject, to obtain as quickly as possible all the available cash they can lay their hands on being considered by no means degrading. But even here subtle dialectic comes into play; the Arab must always have right on his side, for in studied and complex hypocrisy they have nothing to learn from us. If an Arab would rob his guest—I am speaking from personal experience—he will first talk at length on the subject of honour, hospitality, and so forth; he will gradually work the matter round as to why you are travelling, throw out suggestions that spies, enemies, and intruders cannot claim hospitality, suggest that he himself is poor, question himself as to whether he ought not to detain you as a prisoner, again state that he is in want, and thus shift from blackmail to cajolery, and from gentle requests to threats, until he has extorted a sum of money which, in his curious brain, he might describe as the least he could accept with honour, or the most he could extract without danger to himself.

Another point in the Arab's character is his intense dislike of bloodshed and savagery; the tribes of the Jazirah are continually at war, and, as I have had plenty of evidence to the contrary, I think it would be absurd to accuse them of cowardice; but no one who has seen them or talked to them can fail to be struck with their extraordinary lack of vindictiveness, and their wonderfully merciful way of fighting. An Arab never fights to kill; his objects are to capture, to incapacitate, or to frighten into submission. He will, it is true, do a great amount of material damage—burn villages and ruin crops—but he will never take a life unnecessarily or refuse quarter, and never, as far as I know, beat or ill use a prisoner. On the other hand, a desert Arab will rob and tyrannize over his weaker neighbours in a peculiarly ruthless way, and always do his best to make agriculture impossible. And lastly, the great point in the Arab's mental attitude is pride and aristocratic prejudice; the Arab is proud of his own blood, and of his mare's blood for its own sake. He will show you a broken-down little crock, and inform you, with perfect truth, that she is of the best blood in the Jazirah; he will also show a fine stallion of his own, and tell you he is a "g'dish," or underbred animal; and there is no doubt it is the bad thoroughbred he admires and prefers to the finest-made cross-breed. As regards his shaykh and tribal leader, he discriminates in an equal degree between the clever warrior, astute diplomatist, and good business man of low extraction and the shaykh of high lineage, who may be a miserable epileptical creature, and always to the disadvantage of the low-born man.

Having given you something of the character of the Jazirah Arabs, we must now turn to their condition and distribution. The Arabs may be divided roughly into two kinds—those who work a little, and those who do nothing at all. The latter are the great shepherd tribes of the Anazeh, Shammar, Adwan, and Tai.* The Tai are a great Bedawi tribe who

* A few of the Tai do do a certain amount of agricultural work.

have been in the Jazirah for countless generations, and, indeed, they are supposed to have migrated northward long before the days of Mohamed. The Shammar, who form the bulk of the Bedawi population, are the descendants of a great invasion which took place some two hundred years ago, and now occupy the greater portion of the pastures between the Khabur and the Tigris south of the Sinjar; while the Anazeh, who are permanently installed on the left bank of the Euphrates above Rakka, have migrated thither within the last few years, chiefly, I think, on account of the great development of agriculture in North Syria. The Adwan, who are a subtribe of the Anazeh, seem to have drifted northward in the wake of the Shammar invasion. The condition of life among these nomads is equally simple whether they be rich or poor. Their wealth consists entirely in sheep and camels, and their only business is to drive their herds from place to place in search of pasture; in winter the tendency is northward, and in summer and autumn towards the south; but there are really no fixed rules, and springs and water-holes are so abundant that they are seldom much pressed to find new camping-grounds. The serious business of their life is in keeping up the regular and endless warfare in which they are continually engaged with one another. Their method of fighting is almost entirely confined to the use of the lance, which is carried javelin-wise,* the lance itself being a light bamboo some 18 to 20 feet in length, with a long knife-like head. Their tactics consist in a band of horsemen, from two to three hundred in number, swooping down on the herds of the enemy, some driving off succour, while others carry away the booty. The defence of the herds against these attacks is similar—a swift pursuit and an endeavour to draw off the marauders being the usual method. However, generally the advantage lies with the attacking force, as the defenders usually look to recouping themselves by a similar attack rather than to recapturing the lost herds immediately. In this, again, we may notice a peculiar Arab trait of character, for the reason is that the marauding party, if hard pressed, might hustle the captured animals unduly, and so render them almost worthless.

The rules of war in the Jazirah are as strictly and decently observed among Arabs as by the white and red Knights in 'Alice in Wonderland.' To kill an enemy in battle is discreditable and savage; to wound slightly is what is aimed at, and to wound a man slightly with a bamboo lance 20 feet long is no small feat of skill. To surrender is not discreditable; flight is as justifiable as attack; to carry on warfare at night would be scandalous and shameful, or, if we choose to take a cynical view, productive of inconvenient reprisals. Camps, as far as I could ascertain, are practically out of bounds for a similar reason. It will be seen, therefore, that warfare in the Jazirah is an elaborate form of sport, and

* That is to say, with the thumb towards the shoulder and the middle joints of the fingers upward, the lance being held over the shoulder.

I might add that one small view I had of the action of a marauding party convinced me that it was a sport which, for excitement, pure undiluted fun, suspense, and delight, left fox-hunting as far behind as fox-hunting might be said to outdistance lawn tennis; and for this reason, I think, although Bedawin of the Jazirah care little for the chase and are rather poor horsemen, they may be said to be the finest sportsmen in the world. I have yet to hear a Bedawi speak ill of his enemy, even though he may have had the worst of it himself; indeed, as far as I could see, there was as little personal animus between hereditary foes as exists between two elevens of our cricketers. Of course at times regrettable things are done, but the occasions are very rare indeed; the only really discreditable aspect of the intertribal warfare is the ruthless way in which the Bedawin of the shepherd tribes plunder the poor agriculture dependents of their antagonists, who, having neither arms nor horses, are incapable of defence and afforded little by their patrons.

It is now my duty to draw your attention to the condition of the agricultural Arab tribes, the Weldi, the Baggara, the Aghedaat, the Jibbur, and the Afadileh. These people, who dwell in tents similar to the Bedawin, are branded with the ignoble name of fellahin, which signifies that they have sunk so low as to work with their hands. Indeed, they do it very badly, but still the contamination of manual labour places them on a lower plane in the eyes of the desert Arab. In character, save that they are more hospitable and civil to strangers, they are the exact counterpart of their brethren the shepherds, many of them are of equally noble blood, and alliance with their women is not deemed dishonourable by the noblest. Their wealth or poverty depends partly on the crops of maize and doura and barley which they cultivate on the river-banks, and partly on their herds of buffaloes, which, as the latter cannot leave the banks of the rivers, are fairly safe from raids. Except the Jibbur, these agricultural tribes live in subjection to their neighbours of the desert, to whom they used to pay a tribute, which all agree was far more severe than the tax the Government now levies. However, although the Government extends a certain amount of protection to them, and often recovers looted stock, it cannot as yet guarantee them immunity from continual annoyance and discomfort, and of late many of the Baggara have abandoned cultivation on the banks of the Khabur and have taken to regular herdsmanship. It must also be noted that these agricultural tribes have, in common with many of the Arabs of Syria, the habit of leaving a great portion of the work to the women, and it is no uncommon thing to see a woman with a child on her back either ploughing or digging a canal while her husband dozes in the tent and the boys tend the herds of buffaloes. Notwithstanding their idleness, these Arabs are by no means intellectually stupid; all are imbued with the idea that the advent of the railway will mean great wealth and happiness for them, but have, since the rumours of the Euphrates valley

line first reached their ears in the fifties, grown rather sceptical. It is also my private opinion that the love of money, which is so strong in them, will prompt them to do harder work than they now will undertake. My reason is, that at present the only recompense for labour is personal comfort, for which the Jazirah Arabs have no apparent desire; indeed, their natural frugality is extraordinary. A little boiled rice or wheat, the roughest bread, some dates dipped in butter, or the flesh of a sick sheep or goat that has had to be killed, are their only foods, and this in spite of the fact that greater luxuries are well within their reach.

Having now described the Arabs, I will turn to the Kurds; but before going further, I must say that the Kurds are a very little

ARAB OF SOUTHERN SHAMMAR.

understood people, whose history has yet to be written, and even whose distribution is at present but little known. As regards their general distribution over the Ottoman Empire, and their divisions and racial differences, I must refer such as are interested in the matter to the memorandum I have appended to this paper.* Let it suffice to say that the opinions I express now only refer to those Kurds who inhabit the regions at present under discussion, and do not include the Kurds of Anatolia, the Pagans and Shias of the Dersim, the Zazas north of Diabekir, the Zilan Kurds north of Lake Van, the Kizilbash between Erzerum and Erzinjian, the Baba Kurds of the South Persian border, the Kochkiri branch, and various isolated settlements which

* This will be issued separately as an Extra Publication.

exist in other parts of the empire. Let it suffice to say here that the Kurds who live in the area with which we are now dealing are of four fairly distinct kinds: those who dwell on the southern slopes of the Karaja Dagh who belong to the Milli confederation, the Zazas and Karagech who inhabit the district round Severek and encumber the plains between Diarbekir and the Tur Abdin, and the mixed peoples of the Tur Abdin and the Yezidis of the Sinjar. If it were possible to imagine two colours more distinct than black and white, it would be possible to imagine two characters more widely differing than that of the Arab and Kurd. The pure Kurd is the most unsophisticated and gullible person in the world so long as you keep away from the material issues; his respect for a man who can read and write is almost pitiable; his nature is entirely averse to philosophical speculation of any sort or kind, his difficulty in following an intellectual argument painful, but his raw pawky appreciation of practical facts and material things almost Yorkshire in its directness. Indeed, to me the Kurd has much more of what I would term a Western type of mind, albeit undeveloped, in contradistinction to that which we would associate with the Oriental. I think nothing can make my meaning clearer than the relation of the following circumstance On my way home I had the good fortune to read 'Puck of Pook's Hill.' My wife, who accompanied me on the greater part of my journey, immediately drew my attention to the remarkable similarity which existed between the character of the old knight and several Kurdish chieftains of our acquaintance; and, indeed, the resemblance is extraordinary. If Mr. Kipling had named the knight Abdo Agha, and had dressed him suitably, I assure you you could not have a more correct portrait of a modern Kurdish nobleman.

The Kurds are, on the whole, blunt and somewhat uncouth, silent, and quite incapable of falsehood. If they do wrong—and they often do—they admit the fault in the simplest and most unaffected way. I had a muleteer who was honest, civil, and incorrigibly idle. "Did you ever kill a man?" I asked him one day. "Yes; sixteen on the Khazat road when I was a deserter from the army," came the reply in a voice absolutely unmoved. "You were a robber?" "Yes; but now, praise be to God, I am married and a muleteer." Another salient trait in the Kurdish character is generosity as regards money and lavish hospitality. With the Kurds hospitality is not an excuse for pompous empty boasting, as with Arabs; it is real. The guest is given of the best that can be found, whether he be rich or poor, and recompense is not looked for either in money or in presents. Among some Oriental peoples, for instance the Druses, a noble will not accept anything, but expects you to tip his servants heavily, and I have a suspicion that he sometimes shares in the plunder after your departure; but with the Kurds the following instance will be indicative of the general feeling. We were

travelling through a district among a tribe actually at war with the Government, and halted for lunch in a miserably poor village. Although we had food with us, and it was the month of Ramazan, the chief insisted on our partaking of his hospitality, and the village had to be ransacked to find something presentable. After we had eaten, I gave one of the retainers a small sum of money. Shortly after my host discovered the fact; he snatched the money out of the man's hand, threw it down, and trod upon it, and it was only after considerable difficulty and many apologies that I managed to pacify him. This extreme niceness only, however, obtains where the people are living under a tribal chief. Where they are working as ordinary peasants, money is not only accepted, but looked for; but they are hardly ever exorbitant in their demands, and never clamour after the manner of Anatolian Moslems, Armenians, or Arabs. Another peculiarity of the Kurd is his curious shame of his origin. A Kurd Agha, as a rule, will try to explain to you that he is of Arabian extraction, and that only his people are Kurds. There is, I believe, an Arab proverb which says, "The mule said my uncle was a horse." Certainly the Kurd has a similar feeling. If he commits a crime, he will say, "But I am only a Kurd, I know no better." Or if you ask a Kurd some religious question, he may answer, "I am no better than an animal, I know nothing."

The Kurds are also often peculiarly ruthless in their violation, or at least non-observance, of the convenient laws of war. To them the person of an ambassador and a guest is not absolutely sacred if he also happen to be a serious enemy. For instance, I recollect the case of two tribes who had been at war for some time. The chief of one of the tribes felt that unless he made peace his tribe would be ruined; he accordingly went to the tents of his enemies to treat for peace. They gave him food, but did not eat with him. They then told him that they had discussed the matter, and ordered him to say his "fatiha," or profession of faith; while he was doing so they shot him dead. Save for some particular exceptions which I shall immediately refer to, the Kurds are extremely industrious, and well aware of the advantages of material progress; their tents are comfortable, water-tight, and well pitched. The sedentary tribes are very hard working, builders of good houses, and I know of many districts where they are far better husbandmen than the Armenians. The Kurd, of course, will, as a rule, rely on a Christian performing manual labour for him; but, as a matter of fact, where there are no Christians to employ, the Kurd does far better work than a Christian would do for him, whether in carpet-making, ironwork, or agriculture.* There is also one other Kurdish custom, which I think is the occasion of many of their virtues, and that is their

* Those who doubt the accuracy of this statement, I refer for agriculture to the districts south of Giaver; for ironwork, to Sulemanieh; and for carpets, to the Dersim.

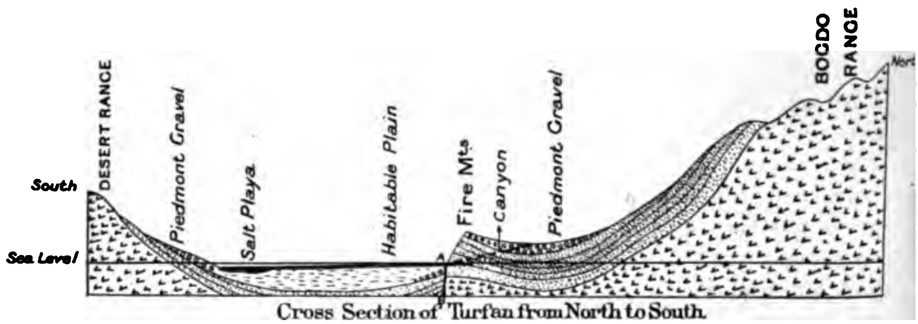
treatment of women. They neither veil them nor impose upon them heavy manual labour. Their women are well clothed, and are free to ride abroad, bully their husbands, and express their opinion in public affairs with as loud a voice as any suffragette could desire. To see a woman of sixty upright as a lance and with a good figure is not uncommon, and that, I think, is a sufficiently striking testimony to any one acquainted with the East.

(To be continued.)

THE DEPRESSION OF TURFAN, IN CENTRAL ASIA.

By ELLSWORTH HUNTINGTON.

The little basin of Turfan in Chinese Turkestan is of peculiar interest, because, though situated in the very heart of Asia, its lowest portion lies below sea-level. Various travellers have passed through it, and for more than a year it was the headquarters of a Russian scientific expedition. Recently it has been the scene of important archæological



Cross Section of Turfan from North to South.
Horizontal Scale of Miles
5 0 5 10 15 20 25
Vertical Scale exaggerated approximately seven times.

investigations by Grunwedel and Le Coq. The name Turfan is becoming well known; but, so far as I am aware, no one has hitherto published any adequate description of the region from a geographical point of view. The basin of Turfan furnishes an unusually good example of the geographical type characteristic of the arid regions of the world. *Physiographically* it consists of a ring of high mountains surrounding a smooth plain of sediments derived therefrom. The climate is so dry that most of the streams wither to nothing on the basin floor, while the rest terminate in an evanescent salt lake or playa. *Geographically*, the chief features are, first, that the dry climate almost inhibits the growth of vegetation in most places, but causes it to grow luxuriantly in the areas which are watered by the mountain streams; and second, that

man, being able to subsist only in a few limited oases where alone water is found, has developed the form of civilization characteristic of arid regions where irrigation is practised.

Upon reaching Turfan at the end of February, 1906, on my way northward to Siberia from the hitherto unexplored salt desert east of Lob Nor, I was at once impressed by the resemblance of the basin to Persia and other arid regions far to the west. At Doksun, or "Ninety," the first town, the days were so warm that the most pleasant place to sit at noon was on the flat roofs of the mud houses, although the night temperature fell to zero. As I looked abroad one noon over an ornamental parapet of sun-dried brick, a dreamy haze softened but did not blur the rounded outline of the pale blue desert mountains to the south. Far to the north and west the snowy tops of the higher peaks of the Bogdo range, rising 12,000 or 14,000 feet, gleamed fitfully among wisps of cloud. At their foot broad naked slopes of gravel were broken by descending lines of little mounds, the heaps of earth around the mouths of the wells by which the "kariz," or underground canals, are entered and cleaned. Nearer at hand the adobe walls of ruined forts or Buddhist shrines stood white and clear in the bright sunshine, while around them stretched a smooth yellow plain, where the reeds were all dead and broken off even with the ground. Nearest of all, four or five Chantos, or Mohammedans of Aryan race, in sober snuff-coloured gowns, and two women, in picturesque red jackets worn over blue skirts reaching to the knee, were spreading manure on grey fields. Two other Chantos in the same field ploughed up the grey soil with wooden ox-ploughs like those used from time immemorial all over Asia. A Chinese merchant, clad in pale blue, walked across the field toward the walled enclosure of the Chinese town; a high covered cart set on a long axle between two big cogged wheels, lumbered by, with one horse in the shafts and three abreast in front, and as it creaked between the high mud walls protecting precious orchards, the lolling driver encouraged his team with shouts of "Owa, owa, owa, *oh!*" and a wave of his fish-pole whip. Suddenly not only the distant scene, but the pale grey, almost dazzling prospect of neighbouring walls and fields was swallowed up in dust. A strong north-west wind had sprung up. Soon it increased to a gale, and I had to leave the roof to two gourds rolling merrily amid clouds of blinding dust. By sitting low on the warm mud oven filling half my room, I could have obtained light enough for my work, if the room had not been darkened by the heads of a dozen or twenty Dungans, or Mohammedans of Chinese race, whose eyes were glued to holes torn or sucked in the paper windows.

That evening, as my Chanto host was entertaining me by playing on a marvellously slender, long-necked tambourine, he remarked, "This wind is nothing. You just wait."

Two days later we were camped in the reedy salt plain 20 miles to

the east, beside a stone wall made of blocks of rock-salt. An evening gale came up, and blew over my tent and that of the men.

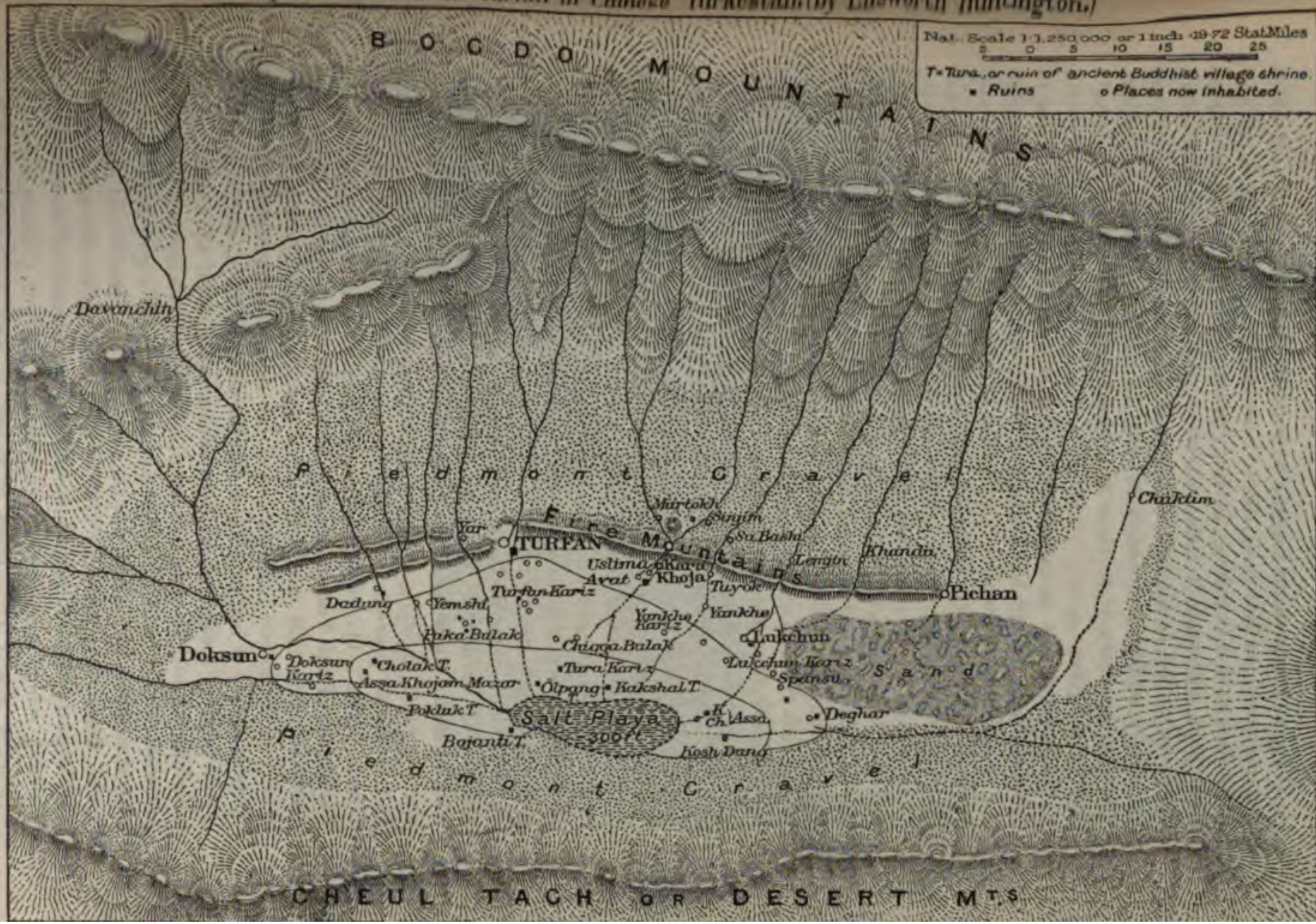
"This is nothing," said the host, who had become our guide. "Just wait till April or May. Then the wind takes the roofs off houses, and leaves the young wheat with 2 or 3 inches of its roots swept bare of earth. All this wind comes from a little lake on the way to Urumchi. There is an iron gate in the lake, and it is only half shut. If any one could shut it, the wind would stop."

I visited the lake on the way to Urumchi—the seat of the Chinese viceroy of the "new province"—100 miles north-west of Turfan, and saw the reason of the legend. Two monoliths, about 7 feet high, stand near the shore. Near them there are a number of artificial mounds of various sizes, and several lines composed of groups of stones. Each group consisted originally of about eight boulders from 1 to 3 feet in diameter, arranged in a circle perhaps 6 feet across. The whole aspect of these relics of an unknown race is almost identical with that of the mounds which I saw in 1903 with Prof. Davis, of Harvard, at Son Kul and Issik Kul, 600 miles to the west.

The climate of Turfan is characterized by extremes in other respects as well as in its winds. On March 5, a quiet sunny day, the temperature was 2° below zero Fahrenheit at sunrise, but rose to 54° above zero at noon in the shade of a high cliff. The summer in this mid-continental basin is of necessity very hot, as might be expected in a place 300 feet below sea-level. Horses, cows, sheep, and camels die unless driven to the mountains. Only the hardy donkey can live through many seasons. In 1894, when a Russian expedition spent a year at Lukchun, on the east side of the basin, the mean temperature of June and August was 87° Fahr., and of July 91°, and the absolute maximum 118°. Such temperatures as those of Turfan render exertion of every kind almost impossible in summer, but they make the fruits of the region most luscious. At the beginning of March I found fresh melons, grapes, apples, and pears in the markets, all of them most delicious and perfectly preserved. The only exception was a kind of pear which is never sold until it is rotted, as the flavour is then supposed to be best. In summer the variety of fruits is, of course, greater. The heat is so intense that melons are cut into strips and dried in the sun. In most parts of the world they would rot long before they became dry.

According to the Chinese, the summer is so hot that during the day the birds all gather in the shade of the trees beside the rivers. If one of them flies up he is scorched to a cinder, and falls sizzling into the water. Another Chinese yarn affirms that the heat is so great that after blowing on your rice to cool it, you must ply your chop-sticks as fast as possible. If you do not, the rice will become hot again and burn you. In winter, as might be expected, Turfan is cold. The mean temperature in January, 1894, was 15°, and the minimum

Map of the basin of Turfan in Chinese Turkestan. (by Ellsworth Huntington.)



$-5°$ Fahr., which seems high in view of the temperature of $-2°$ which I experienced on March 2, 1906. Snow never falls; at least, my host at Doksun said that during the forty years of his life he had never seen any there, although it falls yearly on the mountains round about. Rain, he added, is almost equally rare. Once or twice each summer it falls in sufficient quantity to wet the ground, though not to run. Once in ten years or so there is a cloud-burst, and raging floods ruin fields and houses.

In order to see as much of Turfan as possible in a short time, I planned to go around the periphery of the basin with horses, sending my camels to the capital, also called Turfan, to be sold. It proved impossible to carry out this plan entirely, because south of the playa of Böjanti there is no water. When we tried to go north of the playa, there was so much water that three horses sank into the mud so deeply that we were obliged to unload them before they could extricate themselves. At Deghar, the most eastern village which I visited, we found a queer anomaly. Although the village lies in an almost rainless region at the foot of some of the highest sand-dunes in the world, it not only has suffered from occasional floods, but the houses have to be rebuilt every five years because they sink into the mud. The plain of Turfan is so flat that in spring underground water from the mountains converts hundreds of square miles into impassable muck. It might be expected that plants would grow abundantly, as in the zone of vegetation of the great Lob basin to the south. So they do, to a certain extent, and have done much more extensively in the past. On the whole, however, the water dries up so early in the season that only camel-thorn and a few reeds can flourish.

The chief physical features of Turfan, aside from its arid climate and strong north-west winds, are illustrated in the accompanying map and section. As is usual in the enclosed basins of arid regions, there are four chief divisions arranged concentrically, namely, the mountains, the Piedmont gravels, the habitable plain of fine soil, and the central lake or playa. The crests of the peripheral ring of mountains form the boundaries of the Turfan drainage area, measuring about 80 miles from north to south, and nearly 200 from east to west. On the north and west the Bogdo and other ranges of the eastern part of the Tian Shan system rise to a height of from 12,000 to 14,000 feet, and, being comparatively well supplied with rain and snow, form the source of the chief streams. In most places the lofty mountains are difficult to traverse, so the roads must follow deep, precipitous gorges; but in the neighbourhood of Davanchin, near the Lake of the Winds, mentioned above, there is a pass only 3700 or 3800 feet above the sea. This is the lowest point in the whole of the vast circuit of mountains and plateaux which hem in the great basin region of Chinese Turkestan, extending nearly 1500 miles from east to west and 500 or 600 from

north to south. Wright* has recently stated that "all through Tertiary times" this pass served as a connecting channel between the Arctic ocean, which then covered Siberia, and a great interior sea in Western and Central China. He further holds that since man has occupied the Earth there has occurred a brief submergence by which the whole of Northern and Central Asia was covered by the ocean at the time of the Noachian deluge, and the pass near Davanchin was converted into a strait connecting an inner and an outer sea, as the Strait of Gibraltar connects the Mediterranean and the Atlantic. The theory is most interesting; but I found absolutely no evidence to

A VALLEY IN THE CHOL TAGH, OR DESERT MOUNTAINS, SOUTH OF TURFAN. ICE IN THE FOREGROUND.

support it. Central Asia does not appear to have been covered by the ocean since Eocene times, at the beginning of the Tertiary era millions of years ago.

In contrast to the lofty mountains on the north and west sides of Turfan, those to the south are low, with well-rounded, mature forms. They are intensely dry, and well deserve the name of Cheul Tagh—the Desert mountains. The few springs are usually saline, and there are no perennial streams. Nevertheless, during periods of occasional rainfall they are areas of rapid erosion, like all the other mountains.

The other three concentric divisions of Turfan are areas of deposition.

* 'Scientific Confirmations of Old Testament History' (Oberlin, Ohio, 1906), pp. 214, 302, 309–312, 321.

The coarser waste carried by floods is deposited at the base of the mountains as a zone of Piedmont gravel. In the course of ages the gravel has gradually accumulated to great depths, burying the lower slopes of the mountains, and forming a broad barren expanse like a beach of shingle from 5 to 20 miles wide. In its dry porous depths most of the streams, even those from the highest mountains, gradually lose themselves, disappearing completely. At the inner edge of the zone of Piedmont gravel—that is, at the edge farthest removed from the mountains—pebbles give place to fine clayey deposits forming a smooth plain. The plain is covered with reeds and camel-thorn, half of which are dead. Villages dot it here and there where water can be procured for irrigation. As one approaches the centre of the basin, the plain becomes more or less saline, and the clumps of trees characteristic of villages give place to grey towers of adobe, marking sites once occupied by man, but now no longer habitable for lack of water. Finally, in the lowest part of Turfan, 300 feet below sea-level, the saline plain gives place to a still more saline playa, the central reservoir toward which flow all the centripetal streams from the mountains, though only the one from Davanchin is able to reach it for more than a few days at a time.

The peripheral upland, the Piedmont gravel zone, the inhabited plain of fine soil, and the salt lake or playa fed by withering centripetal streams,—all these are typical features of the basins of arid regions. Two features of Turfan, however, are peculiar: the vast accumulations of sand at the eastern end of the plain, and the little range of the Fire mountains on its northern border. The sand has been taken from the plain and from the gravel zone by the prevailing north-west gales, and has been piled into enormous dunes 500 or 600 feet high. It is dark in colour, because the mountains from which it was originally derived are composed largely of basaltic lava. It forms an absolutely desert region, into the centre of which the natives never penetrate, so far as I could ascertain. They speak of the "Sand mountains" as an unknown region into which they dare not venture far, the home of goblins and demons dwelling in ruined cities which were buried in sand because of the gross immorality of the inhabitants.

The Fire mountains are not volcanic, although their name has given rise to the oft-repeated fiction that an active volcano exists in Central Asia. There is nothing of the sort. The name was given to them by the Chinese because of the brick-red colour of the sandstone of which they are composed. The sandstone is largely of Tertiary age, but part of it perhaps dates back as far as the Cretaceous. It varies from very coarse to very fine in texture, and is often interrupted by bands of light-coloured clayey shale or of gypsum. Everywhere it is full of ripple-marks, raindrop prints, mud cracks, and the like. These features, together with the absence of fossils, the inconstancy of individual

layers, and the prevailing red colour, show that the strata were deposited sub-aërially, and that the Turfan basin has not been submerged beneath the sea during recent geological times. They also prove that throughout the Tertiary period the climate was, for the most part, as dry as it now is.

The structure of the Fire mountains will be readily understood from the cross-section on p. 254. At a very recent date, geologically speaking, a fault or dislocation (A–B in the cross-section) took place along an east-and-west line parallel to the Bogdo range and about 40 miles from the main crest. North of the fault a long narrow strip of the Earth's crust about 5 miles wide was uplifted and tilted so that it dipped northward. To the south the plain of fine soil dropped to a lower level, and the

YOUNG MEN OF TURFAN DIGGING THE STALKS OF REEDS WHICH DIED CENTURIES AGO AND ARE NOW TO BE USED AS FUEL. THE FEATHERY WEEDS ARE CAMEL-THORN.

front of the tilted strip was left as a steep, inaccessible red escarpment about 2000 feet high. At its western end, beyond the low place in the mountains where, as the map shows, Turfan is located, the fault splits into two parts, giving rise to two steep southward-facing escarpments. The recency of the Turfan faults is proved by their relation to alluvial terraces. In Turfan, as in the other arid regions of Central Asia, the alternating moist and dry climates of glacial and interglacial epochs caused the streams to form five terraces. The oldest is large and much dissected, the youngest very small and fresh. All five of the terraces are found in the valleys which cut across the Fire mountains, but only the two lower ones are continuous on both sides of the fault line. The

other three were cut off by the fault, and end in mid-air where they reach the escarpment. On the downthrown side south of the fault they have been completely buried in more recent deposits. Evidently the little red range of the Fire mountains did not come into existence until the three major glacial epochs had passed away. By that time man certainly existed in Europe and probably in Asia.

The occurrence of the Fire mountain fault was most fortunate for man. If the inner edge of the zone of Piedmont gravel merged everywhere into the finer deposits of the central plain, most of the water from the mountains would be irrecoverably lost. Part, perhaps, would reappear in the form of a zone of vegetation, as it does in the Lob basin, but, nevertheless, Turfan would be almost uninhabitable. While the red range was being uplifted, floods from the Bogdo range cut gashes across it—narrow red canyons with wonderful scenery. A glance at the section on p. 254 shows that the heads of the canyons penetrate into the very heart of the gravel deposits which deeply fill the hollow between the Bogdo range and the Fire mountains. Thus most of the water, which seems to have been lost at the base of the higher range, is brought to light again. It wells out in springs at the upper ends of the canyons, where it supports a few villages upon the narrow terraces; then, with ever-increasing volume, it dashes down the steep red gorges and emerges upon the central plain, where it supports the largest among the flourishing oases of Turfan. Farther south and on either side of the main streams from the canyons, no surface water is available for irrigation. Hence the people have adopted the Persian device of the "kariz." This is an artificial scheme for doing what the red canyons do—that is, for tapping the water stored deep underground. Along the line of greatest slope of the central plain a tunnel is dug. It slopes at a less angle than the surface of the ground. Thus, beginning as an open ditch, it soon assumes the form of an underground tunnel, reached by wells from the plain above, and lying farther and farther below the surface as it is followed mountainward. Near its head it reaches layers of gravel or earth which are saturated with water. This flows down the gently sloping "kariz" until it reaches the mouth of the tunnel, and then comes to the light to support a village. Unfortunately, "kariz" water is more or less saline, and soon ruins the fields, unless they are very heavily manured. The lines of wells by which the "kariz" are entered and cleaned form one of the most unique features of Turfan. Everywhere one sees them by the score, each consisting of a mile or two of crater-shaped piles of gravel surrounding the closed mouths of the wells, which lie a few hundred feet apart. An imaginative Chinese told Sir Frank Younghusband that the hundreds of wells were the work of an invading army of his fellow-Celestials, who found that the heat of Turfan made water scarce. Every spring each "kariz" is cleaned. Professional "kariz"-men go

down the wells and clean out the year's accumulation of mud, together with a vast number of water-snakes, so I was told.

Looking at Turfan as a whole, the scenery of the basin is uninteresting. The lake is a mere mucky salt swamp; the plain, except where there are villages, is a monotonous expanse of reedy stubble and clay, with a little camel-thorn; the gravel slopes are dreary wastes of barrenness; the Sand mountains, though striking, are peculiarly sombre, by reason of the dark grey and deep purple shades of the long slopes. They lack the delicate details so beautiful in sand deposits of lighter weight and colour. The Desert mountains on the south are so flat-topped and subdued in general outline that one gladly turns from them;

OLD BUDDHIST MONASTERY EXCAVATED ON THE SOFT ALLUVIAL TERRACES OF THE UPPER END OF THE MURTUKH CAÑON NORTH OF KARA KHOJA, IN THE FIRE MOUNTAINS.

even the high Bogdo range on the north arouses enthusiasm only when one approaches it much more closely than the ordinary traveller or inhabitant of Turfan is likely to do. One feature alone, the little red range along the fault-line, redeems Turfan from being utterly commonplace and almost uninhabitable.

I first traversed the Fire mountains north of Lukchun, at the western end of the great sand area. As our caravan approached the mountains, the way led beside a swift brook, bordered by rows of willow, eleagnus, and poplar trees, and by orchards full of fruit-trees. A mile from the centre of Lukchun the guide—by order of the wang,

or native prince, a friendly boy of seventeen—led us to a large mud structure, that we might see a wonderful innovation. It proved to be a little cotton-gin, made within a dozen miles of my home in Massachusetts. It had been exported to Russia, taken to Siberia, and then carried 1000 miles on camels to Turfan. The fact that my people could make such a marvellous machine raised me greatly in the esteem of the natives, and seemed to make them think that the Russians had wronged them by saying that it had come from Russia.

On leaving the cotton-mill we soon came to the base of the steep red escarpment. The form is enough to prove its youth. It rises precipitately from a smooth base-line, which stretches away in an almost straight line far to the east and west. There are no projecting spurs, no retreating valleys. The canyons do not widen at their mouths, but end abruptly at the escarpment. The transition from the canyons to the plain is so sudden that later, after having come down a gorge to the escarpment, I felt as one does when he turns an angle in a narrow path in a dense forest, and unexpectedly finds himself looking out over the unbounded sea. On entering the canyon above Lukchun we found ourselves beside a rushing brook, plunging over naked red rock between high cliffs of gravel forming terraces, or of sandstone forming the main mass of the mountains. The wildness of the scenery set my Ladakhi servants from Northern India to talking merrily of their far-away gorges in the lofty Himalayas. At the end of 4 or 5 miles we emerged from the canyon at the village of Lemjin, lying on the terraces a little downstream from the springs in the Piedmont gravel. As we rode westward along the northern base of the Fire mountains, an utterly different type of scenery prevailed—a vast expanse of naked gravel, stretching northward for mile after mile to the base of the Bogdo range, and rising gently southward toward the top of the low featureless back slope of the red range. Then we turned south again into the narrow canyon of Tuyok, and at once were in another world.

When we came upon the huge ancient monastery or Buddhist lamasery of Tuyok, built largely in caves dug in the terraces, we felt as if we had suddenly been transported to Ladakh and the Himalayas. The village of Tuyok, itself a mere strip on the narrow terraces at the mouth of the canyon, might well have been in the Indus valley. Turfan is crowded with the ruins of Buddhist temples and lamaseries. Each of the ancient holy places has retained its character in spite of the change from Buddhism to Mohammedanism, and the shrines of the past are the shrines of to-day. The chief of them is here at Tuyok. The head sheikh entertained me in his own house. With the freedom from fanaticism characteristic of the Chantos, he took me into the inner shrine, where ordinary pilgrims are not permitted to enter. I fear it was a case of the power of the purse. He supposed that boundless wealth must belong to a man who travelled with a caravan costing

twelve or fifteen shillings a day—as much as the wages of a labouring man for a month. When the sheikh first heard of my approach, he sent a hasty messenger to recall his mother, who had started that morning for Lukchun to attend the wedding of the boy Wang. I remonstrated on hearing of this, but the sheikh answered—

"If the Wang should see her at the wedding, and know that she had

SACRED BUDDHIST TOWER AT SIRKIP, AT THE FOOT OF THE FIRE MOUNTAINS NEAR LUKCHUN. EACH NICHE CONTAINED A LIFE-SIZE FIGURE OF BUDDHA IN HIGH RELIEF. FANATICAL MOSLEMS HAVE DESTROYED AT LEAST THE HEADS OF ALL THE FIGURES.

left great guests at home uncared for, he would be very angry. He sent a special message that we were to show you every honour."

Etiquette obliged the sheikh's wife to mortify her curiosity, and hide her face and run away whenever she saw me; but his mother, simply because she was his mother, could not only speak to me, but could bring meals to my room, though her son must set them before me.

Tuyok is a peculiar town. All of its two hundred and fifty families live by grape culture. They say that they raise absolutely nothing

else, except a little fruit and a few vegetables for their own consumption. Their grapes, a small, seedless, green variety, are taken to Peking for the emperor's table. The raisins made from them are the best that I have ever tasted.

In connection with Tuyok and its special industry, it would be of great interest to attempt a study of the influence of physical environment in moulding the habits and character of the people of Turfan, and of the results of the commingling of Chantos, Chinese, and Mongols in this somewhat cosmopolitan basin. It must suffice, however, to say that most of the inhabitants are Chantos belonging to the same somewhat mixed Aryan race as the rest of the people of Chinese Turkestan. Their ancestors came to Turfan a century or two ago from Kashgar, Khotan, Ak Su, and other parts of the Lob (Tarim) basin.

Archæologically and historically Turfan is of unusual interest, because of the abundant evidence that a great physical change has come over the country during the Christian era. The number of ruins is extraordinary. Most of them date from the Middle Ages. A few of the ruins have been investigated by Russian travellers, whose reports are for the most part inaccessible; but it remained for the recent German expedition under Le Coq to study the archæology of Turfan for the first time with any great degree of thoroughness and scientific method. The reports of this expedition may be expected to throw a flood of light on the history of Central Asia, and especially upon the climatic changes to which the country has been subject. Turfan must be peculiarly sensitive to changes of climate because of its complete isolation from the rest of the world by high mountains, its extreme mid-continental position, and the almost rainless character of the basin floor as contrasted with the more ample precipitation of the surrounding mountains. Hence, if changes of climate have occurred in Asia during historic times, and if they have exerted an appreciable influence upon human history, the relation between climate and history ought to be peculiarly manifest in Turfan.

After the long Tertiary era of dry climate, of which we have seen evidence in the red strata of the Fire mountains, Turfan, in common with the rest of the world, experienced the climatic vicissitudes of the Glacial period. There were no glaciers in the region, except in the higher mountain valleys, but the moister or cooler state of the atmosphere caused the rivers and lakes to increase greatly in size. Hence, the term "fluvial" may properly be substituted for "glacial" in order to avoid the implication of glaciation when speaking of non-glaciated regions like Turfan. In Europe and America it is now generally agreed that the Glacial period consisted of several glacial epochs of ice-advance separated by interglacial epochs of warmer or drier climate, during which the ice retreated. In Turfan river-terraces and old shore-lines show that at the same time there was a similar series of cool or moist

fluvial epochs of river and lake expansion alternating with dry inter-fluvial epochs of river and lake contraction. Each succeeding epoch was less severe than its predecessor, just as successive glacial epochs in Europe were less and less severe.

At Turfan, however, there is a series of alternating lacustrine and non-lacustrine deposits, which indicate that previous to the series of *decreasingly* severe fluvial epochs mentioned in the last paragraph, there was a similar series of *increasingly* severe epochs. The deposits consist in part of pale greenish strata of solid clay, which was evidently deposited in the deep water of a large lake, the expansion of the present playa of Böjanti. At top and bottom these typical lacustrine strata pass into

VIEW LOOKING WESTWARD IN THE INNER FORT OF THE RUINS OF CHOUG ASSA (LARGE ASSA). THE HOUSES, LIKE THOSE OF EASTERN PERSIA, ARE MADE ENTIRELY OF ADOBE BRICKS WITHOUT THE USE OF WOOD EVEN IN THE DOMED ROOFS.

others, which were clearly laid down subaërially or in water so shallow that plants throve vigorously. Part of the non-lacustrine strata are composed of sand; others consist of clay full either of the fossil roots of reeds, or of black carbonaceous matter derived from plants of unknown species; still others take the form of bog iron ore, and some of genuine coal. Here and there in the non-lacustrine beds petrified trees are found. The number of alternations between lacustrine and non-lacustrine strata amounts to at least five, and probably more. All of the strata were probably deposited previous to the beginning of the *decreasingly* severe series of climatic oscillations recorded in the terraces

and beaches, and corresponding to the oscillations of the Glacial period in colder, moister lands. Two hundred miles south of Turfan on the borders of the enclosed lake of Lob Nor, and 1700 miles to the south-east around the similar shallow lake of Seistan, in eastern Persia, alternating lacustrine and non-lacustrine strata are found of essentially the same nature as those just described. The chief difference is that at Lob and Seistan there is no coal. The layers full of reeds are succeeded by distinctly subaërial strata of a pinkish colour, full of little stream-channels and other marks of running water, and sometimes showing rain-prints and mud-cracks, which could only be formed when the surface was exposed to the air. From the evidence of these three places it seems safe to conclude that, in central Asia at least, the Glacial or Fluvial period consisted of a long series of climatic changes involving ten, and probably more, complete cycles, during each of which the climatic passed from warm or dry to cold or wet and back again. At first the extremes of a given cycle were mild, but gradually they increased in severity until a maximum was reached, since which time they have decreased.

In many parts of Asia there is evidence—some of which has already been set forth in the *Journal*—that the last faint climatic pulsations of the Fluvial period are still in progress. Apparently two thousand years ago the country was decidedly cooler and moister than it now is. The early centuries of the Christian era, the Dark Ages, appear, however, to have been characterized by great aridity culminating approximately in the seventh or eighth century. Since that time there seems to have been a complete, though mild climatic cycle; that is, during the Middle Ages there was a partial return to the moister conditions of earlier times, while now the country has again become almost as arid as it was during the Dark Ages. There are many reasons for believing that this conclusion applies to Turfan. Unfortunately, we know but little as yet of the conditions prevailing in Turfan previous to about 800 A.D., but since that time there seems to have been a great climatic change. Grum-Grshimailo, a Russian explorer, visited Turfan in 1889. He says that though the swamp or playa was then, as now, very small and almost dry, Chinese records and an old Turfan song seems to indicate that formerly there was at least a large reed-swamp, if not a lake. The ruins of the town of Chong Assa and of the lamasery of Kichik Assa, at the east end of the swamp near a river-bed which is now dry, point, he thinks, to desiccation. "It would be of uncommon interest," he says, "if one could somehow know when this river existed. The well-preserved river-bed, the finely marked terraces, the ruins of the monastery of Assa on the bank, and a great number of isolated walls which are now half buried in sand—all these indicate that the river decreased in size comparatively recently."

My own observations agree with this on the whole, although I should judge that the ancient water-supply of Assa came from the

north rather than from the east. The largest of all the ruins, Grum-Grshimailo proceeds, are those of Kara-Khoja, a town which was founded between 874 and 913 A.D. After existing through mediæval times, it was finally abandoned at some time after 1644 A.D. The existence of this town coincides with the period of comparative recovery and slightly greater water-supply, which we have inferred during the Middle Ages. In the days of Kara-Khoja, Turfan was renowned for its library, its art, and its craft, as well as its might in war. To-day nothing of this remains. Formerly the region was so thickly populated that the chief of Gaochau, an unidentified town, could put ten thousand men in the field. "If," to quote the Russian explorer once more, "the land was so fruit-

THE OLD BUDDHIST MONASTERY OF KUHIK ASSA (LITTLE ASSA), SHOWING THE TURFAN PLAIN DOTTED WITH CAMEL-THORN. SAND HAS HALF BURIED SOME OF THE BUILDING.

ful, and the population so dense, the question naturally arises, whence came the necessary water for the irrigation of the fields, and for the support of the inhabitants." Grum-Grshimailo hints that the "kariz" may formerly have been more abundant than now, but his main conclusion is that a change of climate has taken place. He does not, however, attempt to decide whether the change was of local or of wide-spread occurrence.

The correctness of Grum-Grshimailo's conclusion as to the density of the ancient population is fully borne out by the vast number of ruins. They dot the plain, not only in districts which are now inhabited, but in more remote regions where no surface water is now available, and where

the underground supply is saline. Ten such places (Cholak, Assa Mazar, Pokluk, Böjanti, Olpang, Tura Kariz, Kakshal, Chong Assa, Kichik Assa, and Kosh-Dung) appear on the map on p. 257, and I heard of others. They form a well-defined zone which was once habitable, but is now too dry and saline for human occupation. In some cases the only relics of man's former presence are adobe "turas," as Buddhist stupas, or shrines, are called in this region, and a few bits of pottery. Elsewhere, as at Cholak, Chong Assa, and Kichik Assa, there are ruins of forts, houses, and lamaseries. The stupas appear to indicate the sites of villages, for they are on the prolongations of watercourses in places where agriculture would be possible if the streams were larger. Moreover, in Lulan and elsewhere, such stupas are the characteristic mark of villages. The forts mark the sites of larger villages or towns. At Chong Assa the pottery-strewn space included within the low outer wall is about three-quarters of a mile in diameter, indicating a considerable population. In addition to the main villages and towns there were probably smaller settlements of some sort. I found relics of these in the shape of forty or more stone graves on the edge of the southern zone of Piedmont gravel between Pokluk and Böjanti. Perhaps they belonged to shepherds, though now none come to the region, so far as my guide knew, because the water is saline.

Outside the zone of ruins located in places where no water-supply is now available, there is, as the map shows, a zone where practically the whole of the present water-supply comes from the "kariz," although formerly a population as dense or denser than that of to-day appears to have subsisted without its aid. During my stay in Turfan I visited all the chief towns, and made careful inquiries as to the total population, the proportion of the total supported by "kariz," the origin of the "kariz," and the location and age of abandoned "kariz." So far as I could learn, the "kariz" was introduced into Turfan from Persia, or Transcaspia at a comparatively recent date. The "kariz" is unknown in the Lob basin except at Imamla, where a Turfanik introduced it a few years ago. It has also been recently introduced at Hami, east of Turfan, but otherwise it appears to be unknown in Chinese Turkestan.

My most intelligent informants were the Beg of Lukchun and a learned mullah of the same place. They both said that the "kariz" was introduced about 1780 A.D., in the days of the Wangs Skender (Alexander) and Yunus (Jonah) of Lukchun, and Suliman (Solomon) who built the great brick tower at Turfan. Previously the people relied on surface water and wells. When I asked if there were no traces of abandoned "kariz" of an earlier time, they said, "No, none except those whose history is known. Among the ruins there are many old wells, half filled with rubbish, but no one has ever found any trace of a 'kariz.' There are some old ones which are now dry, but they were all dug since 1780 or thereabouts. At Assa about fifteen [two of which I saw] were dug sixty years ago

[about 1845], but the water proved so saline that the diggers gave them up without even building houses."

All the people with whom I talked said substantially the same thing, provided they had any idea at all about the matter. On the whole, it seems safe to conclude that the "kariz" is, comparatively speaking, an innovation in Turfan, and that the greater density of population in ancient times was not made possible by its more general use. On the contrary, under its stimulus there has been a marked increase in population during the last century, as I was told again and again. As nearly as I could ascertain, the population of the entire Turfan basin consists of 9500 families, or 50,000 souls. Of these, 5400 families are supported by

SCENE IN THE RUINS OF KARA KHOJA. IN THE NEAR BACKGROUND RISES THE RED ESCARPMENT OF THE FIRE MOUNTAINS, BEHIND WHICH CAN BE SEEN THE SNOW-CAPPED BOGDO RANGE.

surface water, and 4100 by "kariz" water. If it were not for the "kariz" the population of Turfan would be only 60 per cent. as great as at present, and would not number more than 30,000. Only the towns of an outer zone close to the Fire mountains, and at the east and west ends of the basin, would be habitable. There would be nothing to represent the ancient towns, which, though they had merely surface water to rely upon, once dotted not only the zone of the "kariz" villages, but also the still drier, more saline zone farther toward the playa.

In confirmation of the evidence of desiccation furnished by the ruins, the condition of vegetation deserves to be noted. The plain is covered

with beds of dead reeds. Evidently the region was once densely clothed with reeds which have died long since, and have now been broken off level with the ground by the wind. The dead reeds are so abundant that people from the towns dig out the stalks for fuel. Every morning one sees donkeys with bulky loads of ancient reed-stems brought into the bazar from distances of from 5 to 15 miles. The reeds are sold for fivepence a load. The price made a great impression upon my men, for at Tikkenlik, near Lob Nor, a month earlier, we had paid a halfpenny a load for the very best poplar or tamarisk wood. The death of the vegetation may be due in part to the increased use of the streams for irrigation, and to the lowering of the water-level by the digging of "kariz." It is so universal, however, that it is doubtful whether it can all be due to man's agency. Dead reeds occur not only near the villages, but far from them; not only between the "kariz," but below their mouths where the level of ground water has been raised instead of lowered so far as man's action is concerned. Altogether it seems reasonable to suppose that the death of the reeds and the decrease of the population are both due to desiccation.

The history of Turfan, so far as it is known, agrees with what one would expect if the preceding conclusions as to changes of climate are correct. In the earliest Chinese records, dating back nearly two thousand years to the first historical fluvial epoch, Turfan is spoken of as highly prosperous. During the succeeding interfluvial, or dry epoch, embracing roughly the third to the eighth centuries, it almost disappears from history, and seems to have suffered great misfortunes and depopulation. In Asia and Europe alike the Dark Ages appear to have been darkened by the same cause, namely, the distress and migrations caused by adverse climatic conditions in arid regions. The Mediæval fluvial epoch, as we have seen in the case of Kara Khoja, was a time of great prosperity. People flocked into Turfan from every direction, as is evident from the manuscripts in *ten* different languages which Le Coq has found. Aryans appear to have come north-eastward from India; Tibetans northward from their plateau, which was growing cooler and moister and less habitable; Chinese from the east; Mongols and Turkish races from the north; and Syrians—probably Nestorian Christians—from the west.

The prosperity of Turfan came to an end at the close of the seventeenth or early in the eighteenth century. The basin was left almost without inhabitants. At first sight such complete depopulation seemed anomalous. That is, it is anomalous in the sense that so far as climate is concerned there seems to be no direct reason why Turfan should not then have been at least as populous as it was before the introduction of the "kariz," and possibly more so. On closer examination, however, it seems probable that the extreme depopulation of two hundred years ago was due indirectly to the influence of climate. The direct cause

of the disappearance of the people from the villages of Turfan was the raids of plundering Mongol nomads from the surrounding mountains. To-day there are no Mongols in the mountains; the country is too dry. The nearest are at Kara-Sher, 150 miles away. In mediæval times, however, when there was more moisture and vegetation, the mountains are said to have afforded homes to bands of Mongol nomads. So long as they prospered, they lived, we suppose, on terms of comparative peace with their neighbours in the plain. When the change from the mediæval climate to that of to-day began to take place, the nomads must have been the first to feel the pinch. Life, we may suppose, became hard as their cattle and flocks began to dwindle. For this reason, presumably, the bold mountaineers began to plunder their weaker neighbours in the villages. The plain gradually lost a large part of its settled inhabitants, and there was no chance for it to recover while the Mongols remained. The Mongols, more than almost any other race, despise agriculture. Therefore, though they occupied the plain, they did not cultivate it. They still presumably migrated from the plain to the mountains in summer, and ceased to do so only when the mountains became so dry as to be useless for flocks. Then they migrated farther, perhaps dispossessing some other tribe, and Turfan was left open once more to settlement by Chanto immigrants from the Lob basin. The depopulation was merely an episode accompanying the reduction of the mountains to a state where they were too dry to be inhabited by nomads. As an historic incident, it is scarcely worth recording. It may, however, typify events which have taken place on a scale involving continents. If so, it illustrates a great factor which has been neglected in the study of history.

During the last century Turfan has again enjoyed a period of comparative prosperity by reason of the "kariz." The "kariz" has nothing to do with changes of climate directly, but it illustrates how the pressure of difficulties stimulates human inventiveness. The increase in population and in prosperity since its introduction affords an admirable example of man's ability, not only to neutralize, but even to overbalance adverse changes in physical environment.

ON THE INFLUENCE OF ICE-MELTING UPON OCEANIC CIRCULATION.*

By Dr. OTTO PETTERSSON.

(Second Paper.†)

By evaporation of 1 kilogram of sea-water under due precautions we obtain a residue consisting of the solid saline matter dissolved in the water. If we, for example, suppose the weight of this residue to be 35·04 grams, hydrographers in our countries

* Read at the Royal Geographical Society, June 10, 1907.

† See *Geographical Journal*, vol. 24, p. 285.

immediately recognize such water, on account of its relatively high salinity (35·04 per mille), to be Atlantic water, which must have been carried to our latitudes by the great warm-water current of the Atlantic ocean. The determination of salinity in sea-waters thus becomes a matter of importance to hydrographers, because it enables us in a certain degree to trace the origin of waters. The first international conference in Stockholm, 1899, decreed that salinity shall be determined with an accuracy of at least $\frac{5}{100,000}$ or 0·05 per mille of the weight of the water. The direct determination of the salinity of a water is, however, a delicate and difficult operation. Hydrographers therefore usually prefer to calculate the salinity from the amount of halogens per mille contained in the water, or from its density at zero (σ_0). The former quantity, per mille Cl, can be ascertained with a very high degree of accuracy (up to 0·01 per mille) by titrimetric methods involving the use of "standard water," and the density can be measured by physical methods with a corresponding exactitude. The results agree usually perfectly, as will be seen from the following example: S_{Cl} denotes the salinity calculated from the chlorine titration (by the aid of Knudsen's tables *), $S\sigma_0$ the salinity calculated from the density.

In three water samples † taken on May 31, 1900, in Barents sea, lat. 71° 48′ N., long. 49° 38′ E., by Wollebaek, the Norwegian chemists Leivestad and Schetelig found—

Depth of the sample.	Halogens, Cl per cent.	Salinity, S'_{Cl}	Density, σ_0.	Salinity, $S'\sigma_0$.
50 metres	19·30 per cent.	34·87 per cent.	1·02803	34·88 per cent.
70 „	19·305 „	34·88 „	1·02803	34·88 „
100 „	19·30 „	34·87 „	1·02803	34·88 „

There seems thus to exist a strict correspondency between the amount of halogens, the density, and the salinity of sea-water.

The relation of salinity to halogens in the waters in question is—

$$\frac{\text{salinity}}{\text{halogens}} = \frac{34\cdot873}{19\cdot30} = 1\cdot807$$

and the ratio—

$$\frac{\text{salinity}}{\text{density}} = \frac{34\cdot88}{1\cdot02803} = 3\cdot391$$

Variations in the Chemical Composition of Sea-water from the Tributaries of the North Atlantic Ocean.

Some ten or fifteen years ago the question was much debated, whether these ratios were constant and representative for all kinds of sea-waters. In that case the numbers 1·807 ("chlorine coefficient") and 3·391 ("density coefficient") would assume the character of constants of nature which ought to be determined with the greatest possible accuracy. Dittmar found the ratio between salt and halogens in oceanic waters to be = 1·805. Tornœ, in his analyses of waters from the Norwegian sea, used the coefficient 1·809; and F. L. Ekman finally, as a mean number from his experiment with Baltic waters, introduced the factor 1·81.

When I, in 1881, assisted by G. Forsberg, analyzed the water-samples of the *Vega* expedition, we found still higher values for the chlorine factor, viz. up to

* 'Hydrographische Tabellen,' herausgegeben v. M. Knudsen. Köbenhavn: 1901.

† F. Nansen, 'Northern Waters,' p. 40. Christiania: 1906.

1·83, and we constated *that the ratio : salt to halogens was greater in coastal waters, as, for example, in those from the Siberian sea or the Baltic, than in oceanic water.* The reason was obvious. If we dilute a sea-water sample with pure water, the relation of its saline constituents to each other remains constant. In the Siberian sea, the Baltic a.O., the Atlantic water becomes diluted from admixture with the water of rivers, which contains a small quantity of salt of other composition than sea salt. The chief difference is that river-water contains less chlorides and more sulphates, silicates, etc., in proportion than sea-water. This accounts for the fact that the proportion of salt to halogen in a sea-water increases the more it is diluted with fresh-water from rivers, while the proportion of salt to density is not altered correspondingly.

The International Hydrographic Conference of Stockholm in 1899, therefore, found it indispensable to arrange for a revision of the physical and chemical constants of sea-water before the commencement of the international hydrographic research. The result of this revision is contained in the 'Hydrographische Tabellen' of M. Knudsen, which is founded upon analyses of about thirty sea-waters from different localities in the Atlantic and Indian ocean, the North sea, the Baltic, Mediterranean a. O. Thereby the variations caused by river-water a. O. influences in the coastal regions of the ocean are taken into account, so that we are able to calculate the halogen from the density, and *vice versâ*, and the salinity either from the halogen or the density, with the result shown above, viz. the S_{Cl} and S_{σ_0} are identical up to 0·01 per mille in all ordinary cases. It must, however, be observed that this high degree of accuracy can be expected to hold only for such waters as those which formed the basis of Knudsen's analyses, viz. waters from the surface of the tropical and temperate parts of the Atlantic and Indian ocean and their tributaries. Arctic waters and water from the great depths of the oceans formed no part of Knudsen's research, because the influence of river-water must be confined to the uppermost layers.

The investigation of the hydrographical constants of sea-water has now been extended to arctic waters and deep waters by Nansen, Helland Hansen, Schetelig, and Leivestad. In a treatise from 1906, 'Northern waters,' Nansen communicates the following interesting facts,* which prove that some other cause than the admixture with river-water must be working in the ocean, which can exercise influence upon the quantitive proportions of the constituents of its water. This influence manifests itself by exceptions from the rules laid down in Knudsen's tables, *imprimis* by the fact that S_{Cl} becomes $\gtrless S_{\sigma_0}$ for such waters.

I. In the upper water-layers of the Barents sea, from 0 metre to 40 metres depth, there was found in May, 1900, an excess of halogen, S_{Cl} being about 0·026 per mille greater than S_{σ_0}.

II. In the upper water layers of the sea east of Greenland, the amount of halogen in July, 1901, was found slightly too small, S_{Cl} being about 0·008 per mille lower than S_{σ_0}.

III. The deep water of the eastern part of the Barents sea is deficient in halogen, S_{Cl} being up to 0·015 per mille lower than S_{σ_0}.

IV. The deep water of the Norwegian sea is also deficient in halogen, S_{Cl} being between 0·01 and 0·03 per mille lower than S_{σ_0}.

The cause of these anomalies in the normal composition of sea-water is the freezing of sea-water in the Arctic regions of the ocean, and the melting of sea-ice, which is transported to lower latitudes by the polar currents.

* F. Nansen, 'Northern Waters,' pp. 10, 12, 40, 51, etc.

Being commissioned by A. E. Nordenskiöld, in 1880, to work out the hydrographical results of the *Vega* expedition, I found among the great number of water-samples to be analyzed some flasks containing a very concentrated brine, which had been collected upon the ice-fields of the Siberian sea, where it formed shallow ponds or lagoons upon the ice. Around these lagoons was found a mass of minute salt-crystals, so thickly crowded that they resembled a vegetation of lichens around the borders of the lagoon. The Russian denomination of such crystals is "rossol." This was evidently a product of the freezing process of sea-water under the intense winter cold of these regions. On analysis, both brines and crystals were found to possess a chemical composition which quantitatively was extremely different from that of the sea-water from which they had formed. The most prominent difference was the excess of halogen, in proportion to the salinity on the whole, and especially to the amount of sulphuric acid, which was found to exist both in the brines and in the "rossol" salt. I was naturally led to the assumption that those constituents of the sea-salt which were found in reduced quantity in the residue after the freezing process, viz. in the crystals and the brines, must have entered into the composition of the sea-ice. This was also found to be the case in a great number of analyses of sea-ice of different origin, which Mr. Forsberg executed at my * request. From these facts I arrived at the following conclusions:—

(1) Ocean-water is divided by freezing, not into pure ice and a more or less concentrated solution of ordinary sea-salt, as was formerly believed, but into two saliniferous parts, one liquid and one solid, which are of different chemical composition.

(2) The formation of sea-ice is chemically a selective process. Some of the elements of the salt water are more fit than others to enter into the solid state by freezing; those which are rejected by the ice will preponderate in the brine, and *vice versâ*. Taking the relation $Cl : SO_3$ as standard of comparison, we may characterize the most striking feature in the freezing process thus—that the ice is richer in sulphates, the brine in chlorides.

(3) The extraordinary variation both in salinity and chemical composition of every individual specimen of sea-ice and sea-brine depends upon a secondary process or metamorphosis of the ice. Its ultimate tendency is similar to that of the original act of freezing. The ice seems to give up its chlorides more and more, but to retain its sulphates. The cause of this metamorphosis has justly been ascribed to the combined influence of time and variations of temperature.

At that time the general opinion was that pure ice was formed at the freezing of sea-water. The small impurities always present in sea-ice were accounted for by adherent sea-water. The fact that the freezing of sea-water involves a separation of its chemical constituents, of which one part enters into the composition of the solid, another into that of the liquid water, made this theory untenable. All our analyses of sea-ice showed an excess of sulphates relatively to chlorides. The salinity of the ice was of course small, and was found to diminish with the age of the ice. But at the same time the disproportion between its content of sulphates and of chlorides became more and more accentuated. Immediately after its formation, sea-ice contains a noticeable quantity of salt—chlorides as well as sulphates, carbonates, etc., with only a slight preponderance of chlorides. Such ice is very different from fresh-water ice in its physical properties. It melts under zero, and begins to show signs of melting by contraction of volume at temperatures far below zero. Thus I found that a sample of ice which contains 0·15 per mille of chlorine,

* O. Pettersson, 'On the Properties of Water and Ice,' pp. 305. (Vega expeditionens vetenskapliga iakttagelser, 1883.)

begins to contract already at $-40°$ C.; that an amount of chlorine of 2·73 per mille causes the ice to contract already at $-14°$ C.; and that ice, formed by freezing at low temperatures of arctic sea-water which contained 6·49 per mille of chlorine, began to contract its volume already at $-18°$ C. The following diagram shows the changes of volume which such ice, formed by freezing of 1 c.c. ice-water (at 0°) containing 6·49 per mille chlorine, undergoes from $-19°$ C. to its melting-point, $-0·7°$ C., compared with the corresponding volumes of pure ice formed by freezing of 1 c.c. distilled water, which ought to melt at zero. The diagram shows, however, that even such ice is not totally exempt from small traces of impurities which cause the ice to contract its volume at 0·1° or 0·2° C. below zero.

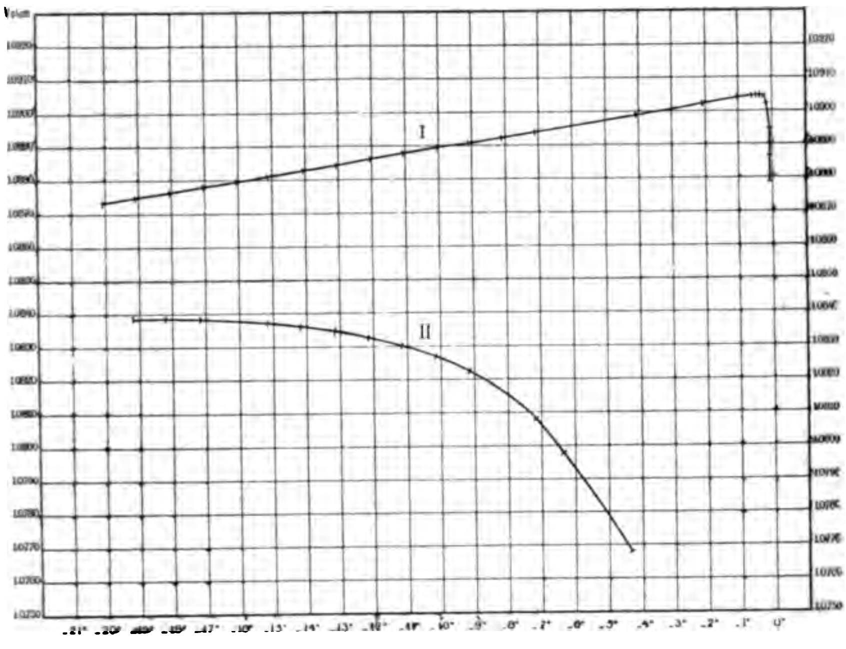


FIG. 1.

The curves I. and II. represent the extreme limits of volume which any ice formed in nature can assume between $-20°$ C. and 0°. The ice formed in the wakes between the ice-floes of the polar sea or in Arctic fjords * under the influence of intense atmospheric cold will, when exposed to temperature changes, behave in a similar manner to that represented in curve II., while such ice as has outlived one or more summer seasons in arctic seas, and meanwhile been transported with the

* E. V. Drygalski ('Grönland-expedition der Gesellschaft für Erdkunde zu Berlin, 1891–1893,' p. 425) found the salinity of newly formed sea-ice to be 4 or 5 per mille. His researches bear out the important fact that the salt is not confined to the uppermost layer of the ice, as Weyprecht believed ('Die Metamorphosen des Polareises,' Wien, 1879). On the contrary, the salt was found to be almost equally distributed in every layer of the sea-ice from the surface to 68·4 cm. depth, where the salinity was 4 per mille. But after two months (from April to June) the salinity in all layers had decreased from 4 or 5 per mille to 1 or 2 per mille.

polar current southwards has undergone a metamorphosis which results in a decrease of the saline constituents on the whole, and leaves nearly pure ice (curve I.), only containing small traces of sulphates, carbonates, etc., which are first given up to the surrounding water when the ice melts.

In my treatise 'On the Properties of Water and Ice,' I tried to explain the chemical changes which accompany the freezing of sea-water * by the formation of kryohydrates or eutectic combinations of salt and water in the solid state. According to Guthrie, the sulphate of sodium forms a kryohydrate with a melting-point nearly equal to that of sea-ice, viz. $-7°$ C., while the melting-point of the kryohydrate of sodium chloride is $-22°$ C. I imagined that such kryohydrates were enclosed in the sea-ice, which thus contained a number of different kryohydrates, as a crystalline rock, *e.g.* a granite, contains feldspar, mica, and quartz. After van't Hoff's discovery of the existence of solid solutions, it is, however, necessary to view the matter from another side, and to regard sea-ice as a solid solution or alloy of salt and water in the solid state.

When this "alloy" melts in warmer parts of the ocean, its saline constituents are set free to mix with the surrounding sea-water. I tried to explain the fact that the proportion of sulphuric acid to halogens in sea-water is slightly variable from the melting of sea-ice in certain parts of the ocean.

Already in 1883 this idea was confirmed by A. Hamberg, hydrographer to the Nordenskiöld expedition to Greenland of that year, who by several series of the most careful analyses proved that the ratio of SO_3 to Cl was greatest in the waters of the polar current east of Greenland. In such samples as had been taken among the drifting ice-flakes of that current Hamberg found the mean relation—

$$100\frac{SO_3}{Cl} = 11{,}499$$

while the mean ratio for surface water from the North Atlantic and Irminger sea with a temperature from $+3°$ to $+11°$ C. was $-11{\cdot}486$. When the Norwegian chemists have found $S\sigma_0$ greater than S_{Cl} by 0·008 per mille in the surface waters east of Greenland, this is in full accordance with Hamberg's results. The difference between $S\sigma_0$ and S_{Cl} is, however, in this case so small that it falls within the possible limits of errors. Nansen justly observes, that in this part of the sea the influence of the freezing of sea-water in winter and the melting of sea-ice in summer will almost counterbalance each other.

In the Barents sea, and still more in the sea east of Franz Josef Land, we meet with different conditions. Here the influence of the freezing of sea water prevails in the upper water-layers (from 0 to 40 metres), as shown by the analyses of Captain Amundsen's samples taken on May 9, 1901, at 69° 32′ N. and 45° 37′ E., in which $S_{Cl} > S\sigma_0$ by 0·026 per mille; and of Makaroff's samples taken in August, 1901, at 78° to 80° N. lat. and 61° to 64° E. long.†

In the deep waters of the Barents sea conditions are reversed, S_{Cl} being less than $S\sigma_0$, whenever the temperature is much below zero, as, *e.g.*, in Makaroff's water-

* Mr. W. E. Renger has newly studied the chemical changes caused by artificial freezing of sea-water at low temperatures: "Ueber die Veränderungen in der Zusammensetzung des Meerwassersalzes beim Ausfrieren" ('Verhandelingen mit het Rijksinstitutet voor het onderzoek der Zee.' Helder, 1906). The composition of the salt which enters into the solid and the liquid part of sea-water at $-5°$, $-8°$, $-10°$, $-25°$, $-30°$ C. has been studied elaborately by Mr. Renger, who denotes $-8°$ C. as the temperature at which the freezing sea-water begins to give up its sulphates to the ice.

† 'Northern Waters,' pp. 10 and 51.

samples from 100 and 200 metres in 80° 26′ N. lat. and 64° 14′ E. long., and in Wollebaek's samples from 71° 48′ N. lat. and 49° 38′ E. long., where the temperature was $-0·9°$ C. to $-1·7°$ C. and $S_{\sigma_0} > S_{Cl}$ by 0·015 per mille.

The same holds also with regard to the deep water of the Norwegian sea. This puts the question from another point of view, and our chief interest will be centred round the problem: Can this deficiency in chloride and superfluity of other salts be effected by the ice melting?

Is it possible that the Barents sea at 350 metres depth, and the bottom layers of the Norwegian sea at 3000 to 4000 metres, are influenced by the melting of the ice, which phenomenon of necessity is limited to the surface layer wherein the ice floats?

The following experiment, which can easily be made before the lantern, will give a direct answer to this question.

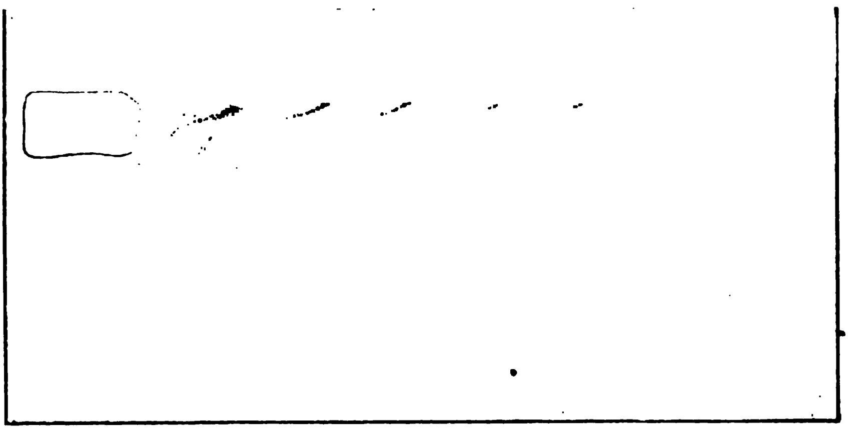
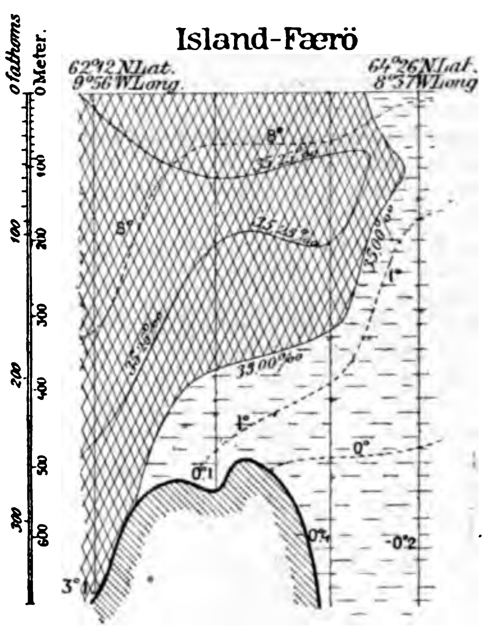


FIG. 2.

Thirty-five grams of chloride of sodium are dissolved in 1 kilogram of water. The solution is heated to its boiling-point. The small quantity of sulphuric acid which exists as impurity in the salt is precipitated with barium chloride in slight excess. After filtration we have a saline solution which has the same density, and on the whole the same physical properties, as ordinary sea-water, but differs from it chemically, in so far that it does not contain any sulphates. A parallelopipedic tank is filled with such water. A small piece of sea-ice, formed by the freezing of ordinary sea-water (which ice contains a small amount of sulphates), is introduced at one side of the tank. The current system shown in Fig. 7 on p. 295 of the former paper (*Geogr. Journ.*, vol. **24**, No. 3) immediately sets up. The under-current which runs towards the ice is quite transparent, while both above and below it the reaction between the barium salt in the water and the sulphates in the ice appears in the upper ("polar") current as well as in the ("arctic") bottom water, which flows along the bottom and banks up against the opposite wall. If the glass jar is provided with a partition (a piece of indiarubber) which reaches halfway up to the surface (Fig. 8, p. 296 *loc. cit.*), the experiment gives a striking illustration of the water-circulation of the Norwegian sea. The flow of the bottom current is made visible by the motion of the minute crystalline particles of the precipitate as it rises over the top of the partition and sinks down again to the

bottom on the other side of it, in the same manner as the cold bottom water of the Norwegian sea banks up against the Iceland Färoe ridge in the following section, and finds its way into the Atlantic ocean. This cross-section of the ridge has been repeated three times by the Danish expeditions. Fig. 14, on p. 305 of the former paper, gives the situation in August, 1903; the following figure is from August, 1904:—



August, 1904.

FIG. 3.

The ice in the experiment is melted by the heat of the surrounding water. But the water which has given up its heat to the ice has undergone a change. In the first place it has been cooled down to very near its freezing-point, thereby contracting in volume and becoming heavier and denser than the surrounding water, and thus sinks to the bottom. Secondly, it has absorbed water from the melted ice, and at the same time some of the substance held in solution by this water. This is made evident when analyzing bottom water which has been formed by contact with the sea-ice. In such water the percentage of chlorine is less than in common sea-water. When the Norwegian chemists found that the ice-cold bottom layer of the Norwegian sea held some 26 million parts higher salinity than was conformable with its percentage of chloride, so is this an evidence that this water was originally Atlantic or Gulf Stream water which has partaken in the process of ice-melting and become metamorphosed or transformed into Arctic bottom water.

Thus the ice melting in the Norwegian and North Polar sea produces a layer of cold water of about $-1 \cdot 3°$ temperature at the bottom of this huge basin, with a salinity of 34·93 per cent. Its temperature is about half a degree above the freezing-point of the water. It will be important in the future to watch the changes that may occur in the temperature of this water-layer. Should it show

signs of a rising temperature, then this indicates that the heat conditions in our parts are improving because more Gulf Stream water is brought hither. If the temperature decreases ever so slightly, so will this indicate that the great warm-water artery of the North Atlantic is ebbing.

Evidently the water masses carried by the Gulf Stream from the tropics to the polar sea cannot for ever go on being amassed there, but must somewhere be transformed into Arctic water. This change takes place when the water is brought into contact with the ice, and this contact gives to the water two typical features, viz. a low temperature with accompanying great density, and a small, but by careful analysis just discernible, deviation from the normal percentage of salts, consisting in an abnormally low percentage of chloride as compared to the total salinity.

The sea-ice formed in winter in the polar sea by freezing on the surface or the layer immediately below does not remain as a thin unbroken cover of the sea. It is continually broken, and the ice-floes are submerged under each other. In this manner the great ridges and screwings are formed which can measure up to 30 feet above the surface of the polar basin. Yet these "torosses," as the Russians call them, have their greatest bulk below the surface, and *it is in their undermost layer that the melting is most intense.*

The site of the ice-melting is always marked by the low temperature which notes the point of equilibrium between ice and salt water, and by soundings in the polar sea a temperature minimum is almost always found at a certain depth below the surface. This minimum marks the greatest depth to which the screwed ice or icebergs reach. In the polar basin this point is found at about 60 to 80 metres; in the Greenland ice-current, according to Hamberg, at about 50 or 100 metres. In the Antarctic, where the icebergs obtain a mean height of about 60–70 metres above the surface * and 300–500 metres below, the minimum will be found at about 300 metres.

It does not follow that every particle of Atlantic water need come into contact with the ice. If this was the case, the temperature of the water in the Norwegian sea must correspond to the point of equilibrium between ice and salt water of 34·93 per cent. or $-1^{\circ}\cdot9$. As the lowest bottom temperature is $-1^{\circ}\cdot4$, or half a degree above that point, this is an indication that the supply of Atlantic water is in excess, so that every particle of this water need not touch the surface of contact. All partake in the melting phenomenon by giving up their heat to the ice, but only part of them will reach the actual surface of contact and absorb some of the melted ice-water with its percentage of sulphate, etc. In the neighbourhood of the ice these particles mix with the other cooled particles which have not been in contact with the surface and sink bottomwards. We must not expect to find real unaltered Gulf Stream water in the immediate neighbourhood of the ice. A layer of more diluted water is always found round the ice in which the melting is conducted. The bigger this area of mixed water, the tardier the melting. In the polar sea we have instances both of quick and tardy melting. When the polar current pushes icebergs into the very Gulf Stream area, as is the case (in certain seasons) south of Cape Farewell, or outside Newfoundland in spring, extraordinary strong movements in the sea-water occur. Such regions I have named *centres of activity of the ocean.* When the polar current in certain seasons retreats, or where it passes over shallow banks, and also in the interior of the Greenland fjords and in the proper polar basin, the ice melts very slowly.

The Russian section of the International Investigation of the sea has discovered a bottom current along the coast bank of Novaya Zemlya, the salinity of which (35 per mille.) equals that of the Gulf Stream water in the Norwegian sea, and whose

* According to Fricker.

temperature is about 1°·7 or more below zero. This is the coldest and saltest water known to exist on the globe. Unsuccessful attempts have been made to measure the velocity and direction of its current, and many theories have been made regarding its origin. From the west, from the Norwegian sea, it cannot have come, for in the western parts of the Barents sea no bottom water of this salinity and temperature has ever been traced. It has been suggested that it might be a bottom current from the Kara sea entering through the Kara strait and following the west coast of Novaya Zemlya northward. The latest suggestion * is, that the

FIG. 4.

water does not belong to any deep current at all, but is formed at the place—that is, on the surface through the concentration of the surface water in freezing. This, however, is impossible; for if ice had formed in this water, its percentage of chlorine should have exceeded, instead of being less, than the normal. My belief is, that this cold deep current is a branch of the Gulf Stream in the polar basin, which, coming into contact with the ice north of Franz Josef Land, has been cooled down to nearly the lowest temperature possible for such water. Earth rotation has

* F. Nansen, 'Northern Waters,' pp. 43, 44.

then deflected its course to the right, round Franz Josef Land, and towards the west coast of Novaya Zemlya. Makaroff, forcing the ice between Franz Josef Land and Novaya Zemlya with the *Yermak*, found in his soundings cold salt bottom water of this type. The samples taken he sent to Nansen, and the analysis of those from the greatest depth gave the result here stated, viz. deficiency in chlorine as compared to salinity. The accompanying map (Fig. 4) shows schematically my idea of the courses of the last branches of the Gulf Stream in the polar sea. Full-drawn lines denote surface currents, dotted lines under-currents, broad lines Atlantic, fine lines Arctic water.

The current chart is an emendation of that in Fig. 20 on p. 313 of my former paper. In the present chart, the Atlantic water in the north-eastern part of the Barents sea is supposed to come as a *cold* bottom current from the north, not from the south. Without hesitation I can now protract towards the Barents sea the current line for the first ramification of the Gulf Stream in the polar basin. Makaroff, Knipowitch, and Wollebaek have all found this cold and salt water in different latitudes in this sea. The high salinity shows that it contains Gulf stream water, which has been transformed into Arctic bottom water characterized by its low temperature * and low percentage of chloride.

The Influence of Ice-melting upon the Water Circulation in the Atlantic and Indian Ocean.

The ice-melting experiment in Fig. 2 shows how a current (the polar current) is set up in the surface when the ice melts, and also how cold and salt Arctic bottom water is formed, which flows on until stopped by some hindrance, and then builds up into a wall of cold water against this hindrance. I will now show how the same phenomenon takes place also in other seas than the Norwegian. A hydrographic section from surface to bottom along the 75th longitude in the Indian sea would, according to G. Schott,† show the termal situation represented in the accompanying figure.

This figure resembles perfectly the situation in our ice-melting experiment. The wedge of warmer water of +2° C. in 300 metres depth, that appears to advance towards the 60th parallel S., is identical with the warm under-current which approached the undermost side of the ice in our experiment (Fig. 2) and occasioned

* Knipowitsch ('Grundzüge der Hydrologie des Europäischen Eismeeres,' p. 1494: Petersburg, 1906) points out that the high amount of nitrogen dissolved in this cold bottom water makes it probable that it has been saturated with air in winter time somewhere north of Nova Zemlja. According to Hamberg's tables, the water ought to have been saturated with air at −2°·85 C. Its actual temperature *in situ* was −1°·7 C. This sounds paradoxical, and warns us not to draw conclusions rashly regarding the temperature of absorption from the nitrogen in bottom waters. There may be other gases than atmospheric nitrogen in such waters, or the nitrogen may derive from other sources than the atmosphere, *e.g.* from the putrefaction of organisms in the bottom mud. A closer inspection of the gas analyses given in Knipowitsch's paper on p. 1206 reveals the fact that the oxygen percentage is very reduced (26·8 to 29·3 per cent. instead of 34 per cent.), and that the carbonic acid is exceptionally high (49·9 c.c.). Such marks in a water from the deepest layer of the sea are far more conclusive than the crude nitrogen determination, which, from the reason named above, may be fallacious. They bear out the probability that the coldest and saltest bottom water of the Barents sea has been excluded from contact with the atmosphere during a relatively long time.

† G. Schott, 'Wissenschaftliche Ergebnisse der Deutschen Tiefsee-expedition auf dem Dampfer Valdivia, 1898-1899,' Bd. I.

the melting. The wedge-shaped layers above on the surface belong to the polar current, and are formed by sea-water mixed with water from melted ice, as in the experiment. Lastly, there is a powerful descending current of salt water, which has given up its heat to the icebergs and now sinks to the bottom of the ocean, flowing towards the equator till stopped and pressed up into mountains of cold

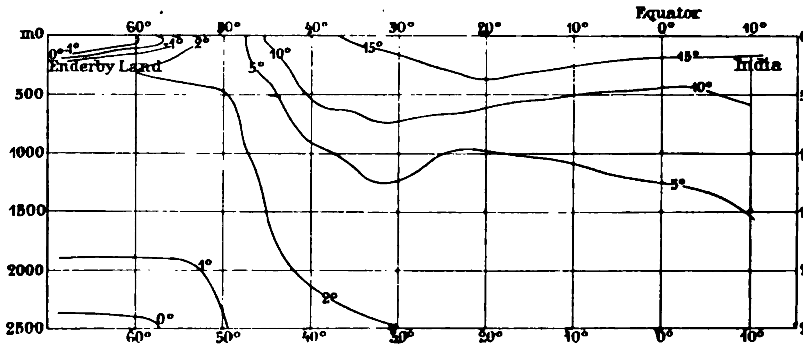


FIG. 5.

water by the southern coast banks of Asia as, in our experiment, the cold bottom current was pressed up against the partition or the opposite wall of the glass tank.

Looking now at the Atlantic ocean, and imagining a longitudinal section along the 30th meridian west of Greenwich, the temperature of the water will be distributed as in the figure below. Here we find the same typical formation—a wedge

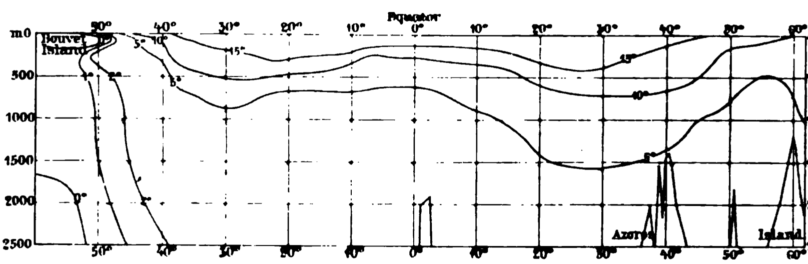


FIG. 6.

of warm water under the surface advancing southwards to melt the Antarctic ice. Above is the polar current, and below is the cold bottom water pressed up into a mountain of cold water under the equator. We might ask, Which is the counteracting agent that forces the bottom water to rise in such a way under the equator? The answer will be, the Atlantic differs from the Indian and Pacific oceans therein, that it borders on ice-filled polar seas both in north and south.

In the Atlantic the ice-melting is conducted both in the Antarctic and in the northern parts of the Arctic sea, from Greenland and Iceland to Newfoundland. The Atlantic thus possesses two sites of melting for the ice, and in its centre, below the equator, the cold bottom currents from both hemispheres meet. The circumstances of this meeting we may derive from the following experiment:—

We put two lumps of ice into our glass vessel, which contains such salt water

as described on p. 287, one at each end of the vessel. The current system that arises is pictured in the above figure. The cold bottom currents meet in the centre of the vessel, which answers to the equatorial area of the ocean, and there their water masses form into a mountain of cold bottom water. The similarity of the situation in the ocean and in the experiment is perfect to the smallest details. We have here

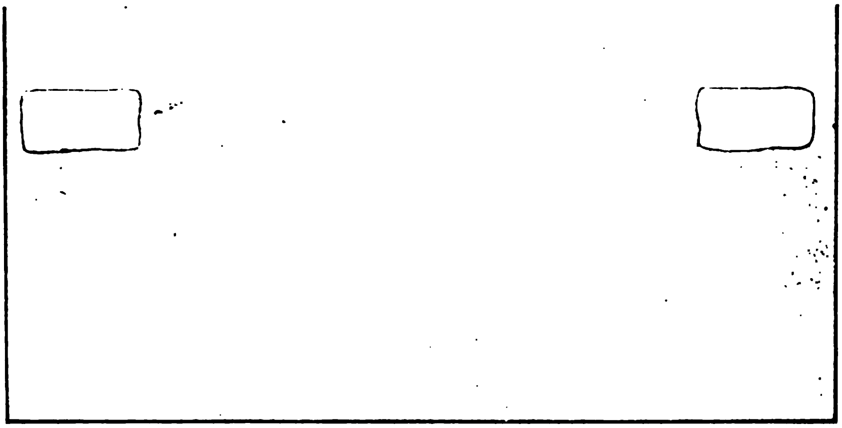


FIG. 7.

the explanation of the remarkable fact that in one of the Earth's warmest localities, the Guinea gulf, where the sea has a temperature of up to 28° C., the warm water-layer is thinner than anywhere else, for only some hundred metres below the surface we find water of 4° or 5° C. *This is probably an effect of the updrift occasioned by the ice-melting in the polar seas.*

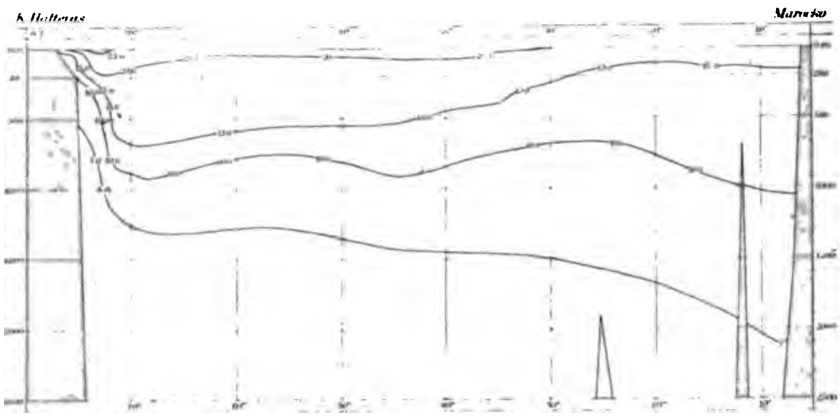


FIG. 8.

It is not only below the equator that this amassing of cold bottom water takes place. We have observed the mighty wall of cold water to the north of the Färoe-

Iceland ridge. Take a section across the North Atlantic from America to the coast of Morocco.

We see how the temperature lines, or "isotherms," rise towards the coasts of the two continents. Here, then, is another updrift of the cold bottom water of the ocean when pushed against the coast banks. Thus between the warm layers of the Gulf Stream and North America's coast there is a ridge of cold water, "the cold wall," and such is the case also on the other side of the ocean too.

It is easy to see that the water which gives up its heat to the ice must become cooler and heavier than its surroundings, and therefore sink to the bottom, breaking through all interlying layers, and that thus the ice-melting in the ocean can influence the circulation in its deepest layers. But it might be questioned if this phenomenon, which is limited to certain areas of the ocean, can play so great a part in the circulation of the oceans as I have suggested. To work the circulation of the ocean involves, of course, an immense expenditure of energy. How can the ice-melting deliver so great an amount of work?

To understand this we must again turn to the Norwegian sea, and observe how the ice-melting is conducted in nature. Between Iceland and Jan Mayen the polar current pushes forward great masses of drift-ice during spring and summer. This drift-ice is melted in the warm water carried thither from the eastern part of the Norwegian sea. On p. 288 of my former paper are represented two maps, showing the position of the ice border in this region of the sea in the year 1896. The first map gives the situation in spring in the month of May. The second map shows the situation in July, when the ice border had receded because of the ice melting.

From May to July an ice-field of about 200,000 square kilometres extension had been melted. In reality, however, the bulk of ice melted has been much greater, perhaps three or four times more extensive than the field in May, for as the ice melts the polar current continues to push forward new masses. Part of this ice, of course, is melted by the heat of the atmosphere, but as seven-eighth parts of the ice is submerged below the surface, the incomparably greater part of melting must be carried on below the water surface and at the cost of the heat of the water.

To melt an ice-field in the northern seas it is necessary that at least seventeen times its weight in salt water should be cooled and sunk to the bottom.* The sinking of this cold water resembles a waterfall more than 1000 metres in height. Like any waterfall on the Earth's surface, this submarine fall can produce work, that is, it can work the deep currents in the ocean. It is the power of this waterfall that presses up the wall of cold water north of the Iceland-Färoe ridge (see Fig. 3 on p. 280), as it is the sinking cooled water in the southern ice sea and at Newfoundland that builds up the cold water mountains under the equator and along the coasts of Africa and America (see Figs. 6 and 8). To the question, What becomes of all this sinking cooled water? our answer, as far as regards the Norwegian and polar sea, is, It overflows the rim of the Färoe-Iceland ridge and sinks to the bottom of the ocean, making a fall of almost ice-cold water 400 or 500 metres below the surface. The question, What becomes of this water in the ocean? must be left to future investigation. It is evident that the water must come to the surface somewhere, but where we do not know for certain, for to this hour the Atlantic is hydrographically an unknown sea—a *mare incognitum*.

The sinking of the cooled water whose store of heat has been expended in

* See O. Pettersson: "Die hydrographischen Untersuchungen des Nordatlantischen Oceans, 1895–1896" (*Petermanns Mitteil.*, 1900, I. and II.).

melting the ice is identical with a waterfall, the effects of which are recognizable in the movement of the bottom layers and submarine currents. The second movement of the ice-melting, *i.e.* the rising of the melted ice-water to the surface, may also be likened to a waterfall, though in inverse direction, for here the water is *lifted from below to the surface.* This too is a production of labour which is made useful in the oceanic circulation, *i.e.* for working the surface currents of the sea, for instance, the polar current. I have estimated the labour thus produced during the ice-melting in summer between Iceland and Jan Mayen as equal to the work produced by a waterfall on the Earth's surface of about 400,000 H.P. These figures represent the energy which drives the water of the East Iceland polar current towards the Färoes. Incomparably greater is the energy produced by the melting of the Antarctic icebergs in the south polar sea. There the melted ice-water rises from a far greater depth, from the undermost side of the icebergs 200 to 500 metres below the surface. As the effect of a waterfall is proportionate to the height from which it falls, it is easy to estimate that every kilogram of ice melted in this depth will produce an energy equal to 7 kilogrammetres.

To get a correct idea of the importance of the ice-melting as a force for working the oceanic currents, we must bear in mind the distinction between *force* and *energy.* Force is possibility for work, but it is not work till an outside energy arrives that can produce work by setting free the force.

An iceberg floating in the sea contains in itself such a possibility for work. It produces a depression in the surface which would be eliminated the moment the ice was taken away. The surrounding water strives to assume a horizontal surface by eliminating the depression occupied by the ice. The water presses the ice upwards, but as long as the ice forms a solid block, its efforts are in vain. The weight of the ice equals the lifting power of the water, which power is localized in the very surface of contact between the ice and the water, but which is unable to produce labour. If heat is brought from outside melting the ice, its molecules will become movable and lifted up to the surface where the melted ice-water flows out, in the shape of a surface current. This, then, is *work,* by setting free the forces that were tied in the contact surface between the ice and sea-water.

Possibilities for such transformation of one energy into another are always present in surfaces of contact where two different substances border on each other. Some such instances may be quoted.

Example (*a*).—Put a solid salt, for instance, common salt or copper vitriol, into a basin of water. Part of the salt will dissolve in the water. The surface of contact between the salt particles and the water is the site of forces endeavouring to drive the salt-molecules into solution. These forces we call the *dissolving tension* of the salt. It drives the salt molecules to dissolve till the water is unable to absorb more or till the solution is saturated with salt. Then a state of equilibrium will arise, because the salt-molecules in the solution set up a counterpressure, which we call the osmotic pressure, against the dissolving tension. If heat is applied from outside, then in most cases the dissolving tension of the salt will be increased so that the equilibrium is disturbed and more salt is dissolved.

Example (*b*).—On the surface of the solution, which is in contact with the air, other forces are active, viz. the vapour tension of the solution which endeavours to spread the water-molecules into the air as vapour. But the formation of vapour from the surface of the solution is counteracted by the vapour tension in the atmosphere. If the solution is heated, the equilibrium between the water-molecules in the atmosphere and in the liquid is disturbed, the vapour tension increases, and new vapour is formed, which must gain room for itself in the atmosphere by displacing a certain volume of air. This is *labour* effected in the manner that some of the

heat energy applied has been transformed into energy or labour in the surface of contact between the solution and the atmosphere.

Example (*c*).—In the surface of contact between two metals, or between a metal and a liquid (electrolyte), exist forces that can generate electric currents, and therefore are called electromotive forces. The pressure or tension effected by these forces we measure in electric units, in volts. If a chemical reaction can take place between the metal and the liquid, the thermochemical energy is transformed into electric energy at the surface of contact, if a passage for the electric current is opened.

Example (*d*).—If two bars of different metals are soldered together, for instance, an iron and a silver bar, and one of the bars is heated, the heat will travel unchanged, that is, as heat energy, through the metal till reaching the junction of both metals. There part of the heat is transformed into electric energy, if a passage for the electric current is opened.

Generally speaking, energy passes through a homogeneous substance unchanged till meeting a surface of contact, where it acquires possibility to transform into a different form of energy. Such is the case with the energy that works the oceanic circulation.

The sun is the source of energy. As long as the energy does not encounter a surface of contact, it passes on its way without effects. In eight minutes the radiant solar energy traverses the distance between sun and earth. At the border of the atmosphere it encounters the first surface of contact, viz. between space and the atmosphere, offering possibilities for its transformation. The surfaces of contact consist of the different layers in the atmosphere, clouds, mist, and dust-particles suspended in the air.

Next, the sun-rays encounter the surfaces of contact belonging to earth and sea. If the earth is covered by vegetation, then every blade of grass, every green leaf, will offer a surface of contact where forces are waiting to be liberated. It is the forces of organic life that, under the influence of the sunlight, build up the cells of the plants. If the sun-rays encounter the sea, then in every drop of water there are similar possibilities for the transformation of energy into the development of planktonal and the microscopic vegetal world of the sea-water. Also in the water itself slumber forces ready to be awakened: the tendency of the water-molecules to transform into vapour. The solar energy promotes this tendency by itself becoming latent heat in the vapour in the atmosphere. *Part of the solar energy, however, will remain in the sea-water as heat, and be carried with the great ocean currents, such as the Gulf Stream, the Agulhas Stream, etc., to the north and south polar seas, where one more surface of contact awaits them,* i.e. *the surface of contact between ice and sea-water.** The heat promotes here the tendency of the ice-molecules to

* There is nothing surprising, from a physical point of view, in the fact that the greater part of the transformation of heat in the ocean is localized to those regions where the polar ice melts in the warmer currents arriving from the tropical parts of the sea. In every hydrographical section through any part of the ocean in which deep soundings have been executed after modern methods, and the results computed after the standard introduced by the International Investigation of the Sea, we are now able to delineate and measure in c.g.s. solenoids the acting forces of the circulation with the aid of Bjerkne's formulæ and Bjerkne's and Sandström's tables. The first results obtained for the Atlantic and Indian ocean are published in 'Svenska Hydrografisk Biologiska Kommissionens,' Skrifter I. and II., Göteborg and Berlin (Springers Verlag). A closer inspection of the diagrams drawn by Sandström in his supplement to my paper, "Ueber die Wahrscheinlichkeit von periodischen und unperiodischen Schwankungen in dem Atlantischen Strom," shows that the c.g.s.

transform into water, and the heat energy itself is transformed into energy of labour working the oceanic circulation, when liberating these forces.

The remnant of the solar energy, when this transformation is completed, is reflected into space, and becomes lost to the earth's heat-store management. Arrhenius suggests * the possibility of still another transformation of the vanishing solar energy. Nature has only one more surface of contact to set against it, viz. the nebulæ which surround the visible part of space with a luminous veil of cosmic dust. Here for the last time the energy may be sifted.

Oceanography is not called on to follow the energy current that passes through the world so far as to the portals of the Milky Way. It aims at accounting for the transformation to which it is subject on its way through the sea, and this is the most interesting task set for oceanography. For the movements of the sea constitute simply a circulation of waters between surface and bottom and between the tropics and the polar seas. Every water-particle that travels polewards is corresponded to by another travelling towards the equator, and is in itself nothing but a vehicle for an invisible reality, the energy, which has another destination.

The Influence of Ice-melting upon the Chemical Constitution of Sea-water from the Atlantic and Indian Oceans and the Antarctic Sea.

The question naturally arises, how far the ice-melting in other parts of the ocean can influence the quantitative relation between the chemical constituents of sea-water. We can ascertain that in two ways, either by studying the relation of S_{Cl} to S_{σ_0}, as the Norwegian chemists have done, or by accurate determinations of the relation of SO_3 to Cl.

At my request Miss E. Pettersson, in Stockholms Högskolas laboratory, executed a series of analyses of the latter kind on waters from the Atlantic and Indian oceans and the Antarctic sea. The water-samples were taken by the officers of steamers running between England, the Mediterranean, and India. In order to get general results, the samples from a certain part of the ocean, *e.g.* from Brittany to Gibraltar, were mixed together and filtered before the analysis. In the same manner a number of water-samples taken by O. Nordenskiöld on his Antarctic expedition were selected and analyzed. The amount of halogen was determined as usual by titration after Knudsen's method, the sulphuric acid (in weighed samples measuring about 153 c.c. each) in the manner employed by Schmelck and Hamberg, the weighings being reduced to vacuum and all precautions taken to ensure complete uniformity in the operations. Two chlorine titrations † and two analyses of sulphuric acid were made on every water. The chlorine titrations gave in every case identical results.

solenoids are crowded together especially under the 40 50th lats. north and south, where the influence of the ice-melting prevails. The mechanism of oceanic circulation can be resembled to that of a pumping-engine, of which the boiler is placed in the tropical and the condensers and cylinders in the Arctic and Antarctic regions of the sea.

* 'Lehrbuch der kosmischen Physik,' 5, p. 232.

† The density σ_0 of the waters was not determined, because I feared that the results would be misleading on account of the possibility that some of the samples, which had been preserved in glass bottles more than a year, might have taken up Na_2SiO_3, etc., from the glass.

Locality temperature.		Cl per mille.	SO_3 per mille.	$\frac{100\ SO_3}{Cl}$	Depth.
North Atlantic ocean, eastern part, Bretagne — Gibraltar. Oct. 1902 and Feb. 1903	11°·5–19°·7	19·89 19·89	2·264 2·268	11·38 11·40	Surface.
Indian ocean, Aden—Ceylon. Oct. 1902 and Jan. 1903	22°·6 –29°·58	20·09 20·09	2·290 2·289	11·40 11·39	"
North Atlantic ocean, 32°–26° N. lat., 19°–21° W. long. Nov. 1901	20°·98–22°·42	20·50 20·50	2·339 2·347	11·41 11·44	"
Antarctic sea, Jan.–Feb. 1902, 63°–66° S. lat., 44°–55° W. long.	under 0°	18·50 18·50	2·119 2·117	11·45 11·44	Depths from 0–40 metres.
Antarctic sea, Jan. and Feb. 1902, *ibid.*	under 0°	18·48 18·48	2·094 2·110	11·33 11·41	Depths from 10–400 metres.

In the Atlantic and Indian oceans there seems thus to prevail a greater uniformity in the chemical composition of the waters than in the Norwegian and Arctic seas. The uniformity is far greater than we could expect from some analyses of Atlantic waters recently published by M. Thoulet and some of his assistants. The great differences between S_{Cl} and S_{σ_0} * found by these hydrographers have, however, been found not to exist by subsequent analyses, made by Mr. Allemandet at the Oceanographical Museum in Monaco and by Mr. Robertson of the Scottish Hydrographic Commission in Dundee, and must depend on analytical errors. The same may in some degree also be the case with their estimation of the ratio SO_3 to Cl. We know, however, too little concerning the Atlantic on the whole to express any opinion about the chemical properties of its bottom water, which must be a matter of future investigation. With regard to the upper layers, the table shows that the influence of the ice-melting is felt also in the chemical composition of the Antarctic surface waters, which show the highest value of the ratio SO_3 to Cl = 11·45, while the water some hundred metres below the ice has the lowest value = 11·33 or 11·41. The corresponding values in Hamberg's analyses of the surface water of the Arctic polar current at 63° N. lat. and 40° 35′ W. long. and the underlying water are 11·51 and 11·46 or 11·48.

The mean value for the oceans found by Dittmar † = 11·576 or by Schmelck = 11·46 cannot be compared directly with the numbers given above, on account of the different standard (chlorine determination) to which they are referred.

* 'Résultats des campagnes de la Princesse Alice en 1902–1903,' xxix. Such differences, if they existed, would in fact reduce the value of the Hydrographische Tabellen edited by Knudsen almost to *nil*. M. Thoulet advocates the principle that every water-sample which can be gathered from the ocean has its own "individual" physical and chemical properties. Theoretically this may be correct, since the vegetable and animal life involves chemical processes which must exert an influence upon the surrounding water, but such changes are too subtle to be traced by the means of analysis hitherto applied. Practically Thoulet has exaggerated the differences in the chemical composition of sea-water existing in nature tenfold. This is a practical question—a question of limits, not of principles.

† 'Chall. Reports: Physics and Chemistry,' pp. 138 and 233.

Hydrographers have long endeavoured to trace the origin of sea-waters from their chemical composition. The investigations here referred open a new way for the study of oceanic circulation, and show that the influence of ice-melting upon the constitution of sea-water can be ascertained by chemical analysis. On the other hand, the high degree of uniformity which prevails in the chemical composition of sea-water bears witness of the intensity with which the circulation is upheld in all regions and in all niveaus of the sea. The ice-melting process is one of the most powerful agents of nature in that respect. The waters which have contributed to the melting of the ice sink, on account of their increased density, to the deepest recesses of the oceans, to which the influence of the winds and the tides never reaches.

Hydrographers will do well to bear in mind the recommendation of the Conference of Stockholm—

"*The chemical analysis shall be controlled by physical methods, and the physical determinations by chemical analysis.*"

The determination of salinity by chlorine-titration must be checked by determinations of the density. In all ordinary cases, both determinations will lead to identical results $S_{Cl} = S_{\sigma_0}$. Whenever a discrepancy is found, it is a sign that some problem of interest to hydrographers is in sight.

Concluding Remarks.

The theory of the influence of ice-melting upon oceanic circulation, of which I have tried to give the outlines in this and in a foregoing paper (see *Geographical Journal*, vol. **24**, 1904, p. 317), has had the advantage of attracting the criticism of hydrographers. Expeditions have been started in order to test certain of the statements made, and scientific papers have been published in order to disprove them. To the last publication of this kind which has appeared, 'Northern Waters,' by Nansen, I am indebted for the elucidation of one point of cardinal interest for my theory, viz. the discovery of the discrepancies between the quantities S_{Cl} and S_{σ_0}, which exist in the deep waters of the Barents and the Norwegian seas. It seems well-nigh impossible to find any other explanation of the fact that "the analytical determination of chlorine gives comparatively high values of salinity near the surface, but comparatively lower salinities for the deeper water of the Barents sea" ('Northern Waters,' p. 11); or that $S_{\sigma_0} > S_{Cl}$, both in the surface water of the polar current east of Greenland, and in the deep water of the Norwegian sea. Nansen, at least, has not given any such explanation.

However useful this opposition against the ice-melting theory has been for its development, I think it is time now to sum up, not only the arguments used against the theory, but also the points in which Nansen and I seem to agree.

I. The intermediary layer of relatively warm and saline water found by the *Ingolf* expedition at about 60 metres' depth under the waters of the polar current between Iceland and Jan Mayen, and by Captain Ryder north of Jan Mayen at 200-300 metres on the slope of the eastern coast bank of Greenland, are, according to the ice-melting theory, an indraught from the Atlantic warm-water current at the opposite side of the Norwegian sea. It was first believed that this warm-water layer derives from an under-current which enters the Denmark strait from the Irminger sea. In his paper on the oceanographical results of the expedition with Michael Sars in 1900,* Nansen, however, admits that "whether the underlying warmer water in this case (between Jan Mayen and Iceland) comes from the north

* See p. 156.

or west, or from the south or south-east, is somewhat difficult to decide at present, though the latter may be most probable."

Concerning the intermediary warm-water layer north of Jan Mayen, Nansen says in his last paper, 'Northern Waters,'* "at any rate, the warm water underlying the East Greenland polar current must come from the Atlantic current (Gulf Stream) running north along the eastern margin of the deep basin of the northern Norwegian sea; and somewhere to the north of Ryder's, Nathorst's, Amdrup's, and Amundsen's stations it must come from the east by a partially cyclonic movement." Our opinions thus agree about the main fact, viz. that the great Atlantic current of the Norwegian sea sends out branches of warm and salt water as under-currents westward both south and north of Jan Mayen, which penetrate under the polar current as far as to the coastal banks of Greenland.† The main features of the current chart which I have schematically designed in Fig. 4 can thus be taken for granted. Difference of opinion still exists regarding the direction of the northerliest branch of these under-currents, which I have traced north of Jan Mayen from Östergren's and Åkerblom's deep soundings and from the calcareous deposits of the bottom in that part of the sea,‡ while Nansen and others imagine that the warm water found at 100–300 metres on the Greenland coast bank belongs to a south-going under-current, which makes a circuit along the coast of Spitsbergen and North-Eastern Greenland, crossing the entrance to the polar basin. This question must still be left open. According to my view of the matter, we have in the western part of the strait, between Spitsbergen and North-Eastern Greenland, the exit from the polar basin. This region of the sea is probably occupied from the surface to the bottom by Arctic water, which leaves no thoroughfare for a warm under-current from the east, *i.e.* from Spitsbergen. The experience from Peary's last expedition shows that the ice and waters of the western part of the polar basin, or the region of the s.c. palæocrystic ice, are moving towards this passage. The outflow from this exit of polar waters is characterized by the lack of an intermediary warm-water layer which is found almost everywhere in Arctic regions, and its surface is marked by a protruding tongue of icefloes, while bights of more ice-free water are found east and west of it, where there exists an intermediary layer or under-current of relatively warm and salt water. Captain Amundsen's stations XIII.–XVI. are situated § within the southerliest part of this truly Arctic region in 73°–75° N. lat. and 3°–4° W. long. Amundsen's stations XVII., XIX., XX., XXIII. are on its western limit at 74° lat. and 6°–7° W. long. In these stations there are found some feeble signs of a temperature maximum at 60–100 metres, while in the former stations XIII.–XVI. the temperature is uniformly under $-1°$ from 20–50 metres to the bottom.

West of this region we have Ryder's ‖ stations and Åkerblom's ¶ station VI. at 73° 47′ N. lat. and 6° 22′ W. long., and VII. at 74° 38′ N. lat. and 15° 3′ W., with a well-marked temperature maximum of up to $+0°{\cdot}71$ C. at 200–300 metres.

* *Loc. cit.*, p. 76.

† Nansen, of course, still maintains his opinion that the presence of these warm under-currents has no influence upon the melting of the ice of the polar current.

‡ Fig. 6, p. 293, *loc. cit.*, *Geog. Journ.*, vol. **24**, No. 3.

§ 'Northern Waters,' pp. 141, 143. Amundsen's station XVI. in 74° 48′ N. lat. and 4° W. long. is the typical representative of the hydrographical conditions of this region.

‖ Ryder and Rördam, 'Hydrografiske Undersögelser, Meddelelser om Grönland,' 17, p. 286. Köbenhavn: 1895.

¶ F. Åkerblom, 'Recherches oceanographiques,' pp. 25, 26. Ups. Univer. Arsskrift: 1903.

East of it we have Östergren's station in 77° 11′ N. lat. and 0° 55′ W. long., where the maximum at 100–200 metres exceeds +1° C. Still more eastward we meet the core of the north-going Atlantic under-current, with its maximum of +2°·63 C. and 35·29 per mille at 200 and 400 metres (Arrhenius' station).

II. In Nansen's former memoir, 'The Oceanography of the North Polar Basin,' this part of the Arctic sea was described as an almost secluded region characterized by extraordinary hydrographic conditions. Geographically, it was separated from the Norwegian sea by a submarine ridge at a depth of 300–800 metres. Over the top of this ridge flowed the under-current of Atlantic water. Above this water from 200–250 metres was a layer of "true polar water" of about 34·40 per mille salinity, which at 60–80 metres showed a minimum of temperature of −1°·8 to −1°·9 C. This is the point of equilibrium of ice and Atlantic water. Nevertheless, Nansen declared the low temperature of this water, in which the polar ice floats to derive, not from contact with the ice, but from the cooling influence of the atmosphere in some unknown part of the polar basin, from which the water was supposed to be an indraught.

Below the Atlantic under-current was another kind of water of a temperature below zero which filled the polar basin from the bottom to the level of the ridge. This water was also supposed by Nansen to have been cooled down to its present temperature in some unknown region by contact with the atmosphere. Between the deep water of the two adjacent deep basins of the polar sea and the Norwegian sea there was little or no communication, and the main feature of the hydrography of the polar sea was that its water had a considerably higher temperature and salinity than the water-layers at corresponding depth in the Norwegian sea (−0°·9 C. and 35·16 per mille instead of −1°·3 C. and 34·93 per mille). My objections to these conjectures are noted in my former paper upon the influence of ice-melting, and need not be repeated, since Nansen's views at present seem to be more in concordance with my explanation—at least, in some important respects.

Concerning the temperature minimum in the upper layer at 60–80 metres, he, upon closer consideration, comes to the result "that Prof. Pettersson's suggestion that this temperature minimum may be due to contact between the sea-water and the ice seems very probably true, although, according to the direct observation made (*e.g.* measurements of the height of the same hummock during a long period of many months), Pettersson is not right when he assumes that an appreciable melting of the ice may be produced by this contact in the north polar basin."

The ice-melting process in the polar basin is naturally a slower one than in the Norwegian sea, on account of the restricted supply of warm Atlantic water, which, moreover, is separated from the ice by the cold upper layer. Nevertheless there exists a gradient of temperature from the Atlantic water of +1° C. and thereabout to the minimum region of −1°·9 C., 150 or 200 metres higher up, which must steadily act in favour of the melting of the undermost part of the ice-floes, which are piled upon each other unto that depth by the screwing of the ice-fields.

Another and more effective agent is the motion of the submarine waves or undulations, which, according to Nansen, stir up the boundary layer between the Atlantic water and the overlying cold water. The amplitude of such boundary waves between two media of nearly equal density can attain a magnitude of 50 to 100 metres and more.

III. With regard to the deep water of the polar basin, Nansen still maintains that its temperature must be higher than that of the Norwegian sea, and cannot, on any account, be lower than 0°·9 C. In his estimation of its salinity he is, however, prone to make a reduction from 35·14 per mille to 34·94 per mille. After

that there is no necessity to uphold the hypothesis of a high submarine ridge. He says,* "This ridge, if it exists, must in that case be very low, rising perhaps to depths where the bottom water of the northern Norwegian sea between Spitzbergen

FIG. 9.—NORTH POLAR CHART.

and northern Greenland has a temperature of $-1°$ C. This low ridge would then prevent the coldest bottom water of the deepest basin in the Norwegian sea from running into the north polar basin. It has, however, been seen that the bottom

* *Ymer*, 3, 1900, p. 325.

water is probably heated from about $-1°\cdot3$ C. to about $-1°\cdot1$ C. on its way from 74° N. lat. to the southern part of the Norwegian sea. And a similar heating must be considered likely on the much longer way through the north polar basin, which must be considered as like a great fjord, where movement of the deep water is extremely slow. The higher temperature is therefore no hindrance in the way of assuming that the bottom water of the latter is the same as that of the Norwegian sea."

Nansen imagines that this bottom water is produced by the cooling influence of the atmosphere in winter upon the surface water of the Norwegian sea in the same region where Captain Amundsen's stations are situated,* viz. between 73° and 76° N. lat., and 4° W. long. and 4° E. long. This is the spot marked with the letter A in the chart (Fig. 9). The chief difficulty of this explanation lies in the fact that the bottom water of the Norwegian sea has a temperature of $-1°\cdot3$ C. and a density *in situ* of 1·02811. If water of so high density has acquired its low temperature from contact with the cold air, it remains to show in what part of the Arctic sea this takes place, *i.e.* where such water exists as surface water. Hitherto no water of this kind has been found, the surface water of the polar basin and the polar current at the eastern side of the Norwegian sea, as well as the Gulf Stream water at the eastern side of that sea, being both warmer and of less density than the water in question at all seasons. Still, Nansen believes that in the region indicated there exists, during some months of the year, water of the named temperature and density at the surface.

The area denoted by A in this chart would consequently, during some months every year, act like an open window, from which water, cooled and saturated with atmospheric gases, would sink down to the bottom of the Norwegian sea, where it would flow northwards over the hypothetical ridge into the depth of the polar basin and southwards towards the southern parts of the Norwegian sea. "During this circulation (which takes place so slowly that the water has spent perhaps fifty years on the distance from 73° N. lat. to 64° north of the Färoes), it is very slowly heated from the underlying warmer bottom, and also slightly from the over-lying warmer water, chiefly by convection. In this manner its temperature near the bottom is gradually raised from about $-1°\cdot3$ C. to about $-1°\cdot1$ C., and perhaps $-1°$ C." †

Hydrographers will have to choose between this hypothesis of Nansen and the explanation given in this and the preceding paper on the influence of ice-melting upon oceanic circulation. In so far I agree with Nansen, that *if* water of so high density as 1·02811 can exist at the surface of the sea—which is not proved yet—it must be sought for in the region denoted with A in the chart, where the conditions are remarkably uniform from the bottom to the surface with regard to temperature and salinity. But I cannot admit that the circulation of the waters in the deep parts of the ocean is a slow process. Under the surface of millions of square kilometres occupied by the Arctic ice of the polar basin and the polar current, thermic forces are at work which incessantly send down cold water to the bottom of the sea. The flow of this cold water is intercepted by the submarine banks between Greenland and Scotland, where it accumulates to a cold wall some 300 to 400 metres higher than the level of the bank, over which it escapes into the depths of the Atlantic ocean.‡

Before the paper, the PRESIDENT: We have met here to-night for two purposes, related to each other. The first is to tender our cordial welcome to the members

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* *Loc. cit.*, pp. 69, 92. † *Loc. cit.*, p. 92.

‡ A communication from Captain Tizard criticizing Dr. Pettersson's paper will be found on p. 339 of the present number.

of the International Council for the Study of the Sea, who have honoured us with their presence here to-night. I shall not enter into details about the work that they are doing. I would not rush in where angels might fear to tread. It is a very technical subject, and after Dr. Pettersson has read his paper there will be a general discussion, in which, I hope, the members of the International Council will take part and give us some idea of the practical results that have been attained, or that they hope to attain, from their inquiries. But I think that you will expect me to say a few words as to the general objects and the history of this International Council. Towards the close of the last century a certain number of experts urged that there should be some scientific treatment of the question of the fisheries, especially in the northern seas. Preliminary conferences were held by delegates of nine Governments—Russia, Finland, Sweden, Norway, Denmark, Germany, Holland, Belgium, and Great Britain—first at Stockholm in 1899, and then in Christiania in 1901, and a bureau was organized, which does its work at Copenhagen. The International Council met for the first time at Copenhagen in 1902, and they are holding their latest meeting—I hope not their last meeting—in London in 1907. I say I hope not their last, because there is a question of dissolution of the Council. It is not a subject upon which I can say much, but I think it would be a thousand pities if an international arrangement of this sort were brought to a close. The relations between civilized countries are not so absolutely cordial as to justify our terminating any form of co-operation. The general object pursued by the Council is an inquiry into the physical conditions of the sea, particularly as regards its varying degrees of saltness and temperatures, which so closely concern the fisheries. I am trying to avoid the word "fish." I dare say you remember that in diplomatic circles there has been a grave question for many years as to whether a lobster is a fish, and I understand that the International Council do include crustacea in their inquiry. Let me just point out here that theirs is a strictly geographical inquiry. We have had lately some high educational authorities asking "What is geography?" and, like jesting Pilate, they have not always waited for an answer. But we hold that geography is concerned, as one of its branches, with the distribution of anything that may exist on the surface of the globe. I suppose it will hardly be contested that the sea forms an important part of the surface of the globe, so that the distribution of fish or crustacea is a geographical question, and that is why it is we have been able to claim the privilege of entertaining to-night the members of the International Council for the Study of the Sea and to introduce them here to the Fellows of the Royal Geographical Society.

So much for the first purpose for which we have met here to-night. The second purpose of our meeting is to listen to an address on the "Influence of Ice-melting upon Oceanic Circulation," which is to be delivered by Dr. Otto Pettersson, of Sweden, who is, as I have no doubt you know, vice-president of the International Council of which I have been speaking. This, of course, is also a geographical question. I shall not attempt to forecast what Dr. Pettersson will say, but I am sure we shall listen to him with the very greatest interest. I now invite him to address you on "The Influence of Ice-melting on Oceanic Circulation."

After the paper, the President: I rise to propose a cordial vote of thanks to Dr. Pettersson for his address. You will have realized the difficulty with which he had to contend in trying to compress into a short time the immense mass of information he has collected. We are much indebted to him, and your applause expresses your thanks for his interesting address. We have another pleasure to-night, as I pointed out to you earlier, and that is to hear the remarks from other members of the International Council for the Study of the Sea. Any thorough discussion of Dr. Pettersson's paper is, of course, impossible; the subject is too

intricate to discuss at a meeting like this, although I do not wish to preclude any one from speaking on the paper who desires to do so. I call upon Norway first to reply, because it is represented by an Honorary Corresponding Member of ours, whom we have often heard before and always wish to hear again, His Excellency Dr. Nansen.

THE INTERNATIONAL COUNCIL FOR THE STUDY OF THE SEA.

Dr. NANSEN: The President has done me a great honour by asking me to make some remarks upon the work of the International Council for the Study of the Sea, a work which has now been carried on for nearly five years, and which we all hope is going to be carried on for a great many more years in the future. The goal of the whole inquiry is, of course, a scientific exploration of the sea, but it has more than a purely scientific aim; our purpose is especially a thorough investigation of the sea, with regard to its various conditions influencing the life of the food-fishes that are important for the nourishment of man. I believe it may be said that our work has been very successful in that respect, and that very important results have already been attained; but this is not for me to go into—more competent men will mention this part of the work later. I would rather say a few words about our physical investigations, which, we hope, will in due time give us a satisfactory understanding of the circulation of the sea, a problem of the greatest importance for the final solution of most other problems connected with the sea. Our observations are in several respects throwing entirely new light on this difficult subject. The vice-president of the council has given you some examples to-night of the physical work which has been carried on. I am sure many of us do not quite agree with him in various points as to the correct explanation of the observations made, but this would not be the place to go into details in this respect; and especially not for me, as I have recently published a paper on it, which Prof. Pettersson has quoted, where I have laid down my own views of the circulation. But in order to give you some idea of the results attained with regard to the circulation of the sea, I should like to show you a lantern-slide demonstrating the circulation in the Norwegian ocean according to the Norwegian investigations of it. It may be good, of course, for more popular representation, to draw charts of the sea-currents like those of Prof. Pettersson's, but they are apt to give misleading ideas about the currents, as people will often speak of them as though they run like rivers through the ocean. The circulation of the sea has, however, no resemblance whatever to rivers; it means the continuous movement of the whole water-masses from the surface to the bottom, and over the whole area of the sea, and we cannot move the water-masses in our part of the sea without moving all the rest. Mr. B. Helland-Hansen and myself have been working up the results of five years' investigations in the Norwegian sea, which is, I am sorry to say, the only part of the ocean which is really well-known, and where we can say something with certainty about the circulation. We hope soon to publish our results, but here I show you a chart of the circulation based on our investigations. You will see that the water has a certain tendency to move in greater and smaller vortexes and whirlpools, and you might, in fact, consider the whole circulation of the ocean as a series of such movements, which, to a very great extent, move in the cyclonic direction. You will see the Atlantic current or Gulf Stream comes into the Norwegian sea, between the Faeroe islands and the Shetlands, and at once it begins to make whirlpools in a most remarkable way by meeting the colder current coming from the north-west past Iceland and the Faeroes, as is proved by the Scottish observations made during four years. I may make the remark here that, according to my view, the chief cause of the circulation of the sea is the combined effect of the cooling of the water

and of the winds. I do not believe that ice-melting has much importance in this respect; I think it has practically no direct effect upon the cooling of the sea, because the ice is formed and melts in the same sea, and the heat which is disengaged the moment the ice is formed is again engaged by the melting process, so the direct cooling effect of these processes is *nil*. Indirectly the formation of ice in the sea has, however, the opposite effect, as the ice-cover protects the underlying water from being cooled by radiation of heat. If, therefore, we had an open North Polar sea instead of an ice-covered one, we should get a milder Arctic and North Polar climate, but a much more cooled sea. But let us return to the Norwegian sea. We see that along its eastern side the warm Atlantic water runs northward, whilst along its western side, the Greenland and Iceland side, the cooled polar and Arctic waters run southward. In the southern part of the Norwegian sea, south of the latitude of Jan Mayen and northern Norway, these currents form a great cyclonic circulation of the whole water-mass, with many smaller vortexes or whirlpools, especially prominent along the western side of the Atlantic current or the so-called Gulf Stream. In the northern part of the Norwegian sea there is probably another similar cyclonic circulation. In the Barents sea there is also such a cyclonic movement of the waters, with many similar vortexes. This chart may possibly give you some idea of the object of the physical part of our work. It is trying, first of all, to give us some solid reliable information of the circulation of the ocean—what its currents really are. But this is not the final object. The further object would be to find the variations in the circulation, because it is evident that these variations have great and far-reaching effects upon various other conditions of the Earth, and are of very great importance to humanity. First of all, it has a very great effect on the *climate*. If we can master the variations of the circulation of the ocean, we shall probably also master important features in the variations in our climate. That is a goal which is still far in the future, but we may hope to reach it some day. On the other hand, it is also evident that these physical conditions are of very great importance to the biological conditions of the animals living in the sea. And when we find, for instance, that the quantity of fish vary much from one year to another, it is not unnatural to think that the cause might be found in variations in the physical conditions of the ocean. The lack of fish in one year may be due to the fact that some years earlier there were certain conditions in the sea which were unfavourable for the reproduction of the fishes. You will thus see that a thorough understanding of the physical conditions of the ocean is of very great importance, not merely scientifically, but also for the fisheries and to practical meteorology. I wish, therefore, to impress upon you the necessity of the nations co-operating in order to make the sea a known part of the globe; we can no longer allow it to remain an almost unknown world, as it is at present.

The PRESIDENT: I think, in view of the visitors who are now in England, whom many of us have seen to-day—I mean the royal visitors—I must call next upon Denmark to speak. Will Dr. Petersen kindly reply on behalf of Denmark.

Dr. PETERSEN: I am not prepared to speak here to-night about this matter, having had very short time to think about it; but if you will allow me, I will speak a little about marine biology. I am a marine biologist myself, and have spent my life in this branch, studying marine fishes, not only from a scientific point of view, but also from an economical view, with the idea that science will conquer this ground too. We know in Denmark what science has done for agriculture, and I hope that science by-and-by will do the same for the sea. Time will not allow me to make a long speech about the whole of the scientific work done in marine biology, but, if you will allow me, I will give you some few examples of the methods and of the results we have obtained. We in Denmark, many years ago, tried to

label a number of fish for the purpose of finding out where the fish migrated to. This method has been employed for flat fish, especially for plaice. We fastened two bone buttons together with silver wire through the plaice, and they were thrown overboard alive; when the fishermen caught them again they told me where they caught them and when, and in that way we found out where they migrated to, and how much they had grown. This method was used by me many years ago, and it has given interesting results. I mention it because it has been in use in all the co-operating countries. I once took three hundred plaice and labelled them, and put them back into the Kattegat. One-third of them were caught after they had been in the sea three months; I never expected to see any of them again at this my first trial. We have made many better investigations and trials afterwards, and we can now give a good report for the different waters. So far as I can remember, 60 to 70 per cent. of labelled plaice in the Kattegat are caught and sent to me in a year. In the North sea the percentage is about 50 per cent. We can learn a great deal from these methods, and I hope the time will come when we shall have learnt enough about the North sea to get a special law for undersized plaice. I should like to say a few words about the results of the investigations of the common eel. Denmark is a very little country, but you will remember that we must go to Iceland and Greenland too—we have only one ship, but it has been round Iceland, in the neighbourhood of Greenland, and it has been in the neighbourhood of Spain also. It looks, perhaps, a little peculiar that we in Denmark are sailing so much in the waters of other nations, because we have made it a common rule that each country shall deal with its own coast. It was a special problem which caused us to go so far. The work on one of these voyages was to find the larval eel. One specimen was first found west of the Faroe islands. Next year the ship went along the west coast of the British Isles, west of Ireland, specially to find some more of these larval eels; and we found a lot, especially south-west of Ireland and off the coast of France and Spain. Therefore we have come to the conclusion that the eels do not breed in the North sea, because their larvæ (*Septocephalus*) are not to be found there. Therefore, all the eels grown up in Sweden, Norway, Russia, Germany, England, and Holland, of course, must go westward in the very ocean to breed. We hope by means of these investigations to be able to improve our eel fisheries. We intend to catch, as far as possible, all the eel from the whole Baltic on the migration to the breeding-places; we have during this to go through the narrow ground near Copenhagen. We hope to be able to stop them there each autumn. I mention it here because knowledge about such a thing as the breeding of the common fresh-water eel has supplied us with the knowledge of how to legislate for the whole eel fishery.

The PRESIDENT: I will ask next one of the representatives of Germany to speak.

Dr. OTTO KRÜMMEL: When we held our first meeting at Stockholm in 1899, our knowledge of the seas bordering northern Europe was still very incomplete, not only as to the physical properties of the water, but as to the food-fishes also. It may be said that now, after five years' co-operation, we have laid very good foundation in both respects. We know the main features of the currents in the Baltic and the North sea, and we have got an idea as to the causes controlling the very complicated movements of the water in the western Baltic. As regards general biology, we shall soon have, at least in Germany, by our well-approved methods of studying plankton, some definite information on the nourishment which the fish find in their waters. By collecting and counting the fish-eggs floating in the waters, it is now possible to state where the food-fishes have their spawning-grounds. Thus our knowledge of the nurseries of the young fishes is growing also. The discovery made by our countryman, Dr. Reibisch, of the means of determining the age of any

fish by counting the rings formed each year in the otoliths, or ear-stones, was extremely useful. This method has now been extended to counting the more or less opaque stripes in the scales and in the vertebræ of the fishes, as has been carried out in the Heligoland Biological Station, under the direction of Prof. Heincke. Not least, we have arranged for very detailed statistics of the main food-fishes landed in our fishing harbours. As our fishermen have had the intelligence to see that, after all, it would be to their own advantage to lift the secret from the fishing-grounds where they have made their best catches, it is now possible by comparative statistics to clear up the productiveness of the various areas in the North sea. For a nation like the German, now growing every year by 850,000 inhabitants, there is no doubt that a rational exploitation of the bordering seas has become a very serious question of food-supply. We hope that the continuation of the international co-operation as to the study of the sea will bring no less profit to the other nations around the northern seas of Europe.

The PRESIDENT: I will ask a representative of Belgium, Prof. Gilson.

Prof. E. GILSON, of Louvain: The President could not have done better than call in the first place the representative of Norway, the country lying nearest the regions where the phenomena, related to us by Prof. Pettersson, have their principal seat, and the country which has produced men like Nansen, Hjort, and Helland Hansen, who have done so much for their exploration, as also for the study and co-ordination of the results obtained. For reasons of an opposite kind, however, the President might, it seems to me, have called in the last place the delegate of Belgium, which of all the associated countries lies the furthest south, the farthest removed from the regions where the fusion of ices produces its most direct effects, and the country, moreover, the last to enter the field of polar and oceanographic research. No doubt it was his intention to pass from one extreme to the other, and to give me the opportunity to remark to you how the region committed to us in the International Exploration includes in it an interest peculiarly its own. It is, specially, the southern threshold of the North sea, the gate of communication between that sea and the Channel. The importance of this communication is proved to have been often exaggerated. In taking an estimate of it there is occasionally left out of account, not only its narrowness, but also its shallowness, and the direct reversal there undergone twice a day by the tidal currents. These circumstances, taken in connection with other observations, sufficed to draw from your illustrious compatriot, Lord Kelvin, the remark that, supposing the strait came to be closed, that occurrence would hardly affect the circulation of the currents in the North sea. Yet, of however small account it may be, this communication is in very actual operation, and offers much that is interesting biologically. And it is from this point of view that we take its study for our special mission. If, then, little has been done in this way in the past, the attention of the Belgians having been but recently directed to affairs of the sea, we yet hope to obtain useful and interesting results in the future.

The PRESIDENT: I propose next to ask Prof. Weber if he will kindly speak for Holland. I am afraid he must speak in English, for I doubt if there are many here who speak Dutch.

Prof. WEBER: I hope you will excuse me, because I am not able to say anything about any of the original work. I have not personally been engaged upon this work, but I can say Holland has produced the General Secretary, and he will perhaps say a few words about the original work, the measuring of oceanic circulation along our coast.

The PRESIDENT: The General Secretary has refused to say anything. I call on the representative of Finland, Dr. Homén.

Dr. Homén: Finland lies far from the great waters of the North sea and the Atlantic, the scene of the hydrographic phenomena about which we have just been hearing excellent expositions. The peninsula of Finland is washed on the west and on the south by the Baltic sea, and its two gulfs of Bothnia and Finland. These waters, it is evident, do not offer for study problems of equal importance and magnitude with those presented by the Atlantic. An almost closed sea, in which already Wilcke witnessed the quick circulation of the water, the Baltic sea supplies a group of questions such as might abundantly reward investigation. For one item, the powerful Baltic current, the superficial current, namely, of water but slightly saline, issuing from the Baltic by way of the Kattegat and the Skager Rack into the North sea, is of great importance for the hydrography of the latter. In order, therefore, to a complete knowledge of the North sea and its currents, the study of this Baltic current may not be left out of account. The investigation of the hydrography of the Baltic, again, constitutes an important part of the programme for the scientific examination of the seas in the north of Europe.

Quite as much, however, as the purely scientific interest, the desire to improve the fisheries induced the Government of Finland to contribute the means needful for the hydrographic research which has since 1898 been uninterruptedly pursued. It is further hoped that the study of the currents, so dangerous to navigation in our waters, will in future yield results of practical utility. The navigation of our seas in winter is for us a question of great economic moment, and the great difficulties opposed to their navigation by the severe congelation to which they are subject have tended to quicken the interest in the question of scientific research in the Baltic.

The publication of the results of our observations accumulated during the last nine years has been begun. In about three years hence it will, I hope, be possible to form a fairly complete idea of the hydrographic phenomena in the north of the Baltic and its great gulfs of Bothnia and Finland.

The President: The only remaining country, Russia, is not represented here, but I believe Dr. Hjort, Director of the Norwegian Fisheries, can give us some interesting information. If he will kindly do so, we shall be very much obliged to him.

Dr. Hjort: When you do me the great honour to ask me to say a few words here, I must take this opportunity to say a little about the idea which has been in my mind these three years, namely, the question as to how this oceanic work can do anything to advance the life of the fisherman. In the fisheries, as in any other branch of human activity, there are periods of expansion and there are periods of economy; so it has been in the fisheries, as you know. The great time was when the British fishermen not only went out to the North sea, but when, after a while, they went to Iceland, and down to Spain and Africa. When the practical man asks you what is the practical use of science, he mostly wants you to find some new fields for fishery; he wishes to discover new banks in order to let the fishermen get more money and let them be able to introduce a new industry. But science is very seldom able to do that, and everybody who has seen the great British fleets, for instance, at Hull, Grimsby, Aberdeen, or anywhere else, will at once understand that merely scientific systems cannot do very much amongst these clever hard-working people; but nevertheless there are some circumstances when science is able to do a work of that kind, and a great part of my work has been in that direction. When we began our investigations, a great part of the Norwegian sea, while not undiscovered and not uninvestigated by soundings, was never tried by any fishing gear at all. This great field was never tried, and all this big sea was very little studied. We had in Norway fifteen years ago a great number of fishermen, perhaps a hundred thousand, but they had only very small open boats, and they fished

from the shore and never went out to the sea to a great extent, because they did not know the sea. Our great object was to go out and to make fishing experiments on one after another of these great banks, of thousands of square miles. We made fishing experiments, and we gave our charts to the fishermen, telling them where they could go, and we have had the pleasure also of seeing a great number of big boats going on grounds where they have never been before, and instead of only having open boats, we have had the pleasure of seeing these people develop a fleet of about 4500 deck boats, and they now go over all these banks, and also to Iceland, while a few years ago they only stayed close to the shore. In this way it has been possible for science to do this work, but this possibility was only due to the special circumstances of these poor people not having the capital which the people here in England have, the capital which enables us to do much more than a private man can do. But as this fleet advances, and Great Britain and all the other countries along the North sea and along the coast of Norway also advance, there will come a time in Norway, as in all other countries, when it will be difficult to advance the fisheries by expansion, and the question will be what can we do by economy? And that question is the other great practical purpose which we are all going in for. This question of economy can, in my opinion, not be stated in a more clear way than by taking an example from the study of human beings, to take a comparison from the science of the population. As you study the population, by statistics you can see if a people, if humanity, is prospering in the different parts of the world; you can see how long they live; and you can see, for instance, as this great science has shown, that the more civilized the world is getting, the longer the life of the people will be. In this way we are able to study fish also. It sounds very difficult to do this, but it is possible; we are able to tell the age of these most important fishes; we can tell exactly how old every herring, every haddock is; we can say how long they live; and in this way we are able to study the lifetime which they have. I can give you some few examples of this. In the spring time great shoals of fish approach the coast of Norway; we catch, perhaps, a hundred barrels of herring here; we catch millions of cod here; and if we study these very carefully we can see that the swarms come in groups of years. For instance, the herrings come in groups of from three to fifteen years, and even eighteen years in the open fisheries here. We can see that other fish are from four to eighteen or twenty years—only the fishery in this big ocean has not been going on so intensely as in the southern part. We have great swarms of fish, and they always give the same idea of being near the limit of dying a natural death. In this way we can also see that one fish is able to produce its kind perhaps twelve or fifteen times before it dies. These swarms give you an idea of a great stock of fish prospering and not being in any danger from man. If that is true — and it is impossible to explain or prove it in a few minutes — then it gives you great hope that you will be able, as an administrator or a scientific or a practical man, to inspire your people to go on developing the fisheries still more, and I think no practical purpose can be greater than that. In other parts of the sea, for instance, in the North sea, by means of your great fleets that sweep over the whole of the ground, if you study the question of the fish, you very seldom find old fish. I saw, for instance, last summer, in Finland, a great swarm come from here where nobody had ever fished before, and there were huge haddocks which never had been under the influence of fishing boats before. These fish were from eleven to twelve years old. If you take the age of the haddocks in the North sea, for instance, you very seldom find such old specimens. The great majority of them are only two, three, or four years old at the outside. Now, I am able to tell you that all these investigations give us a practical picture of the fish in all its uses. I say, we are

able by hard work to give a true picture of what the fish is to be, what the stock of the fish is with regard to the different classes, and we can tell you what the fish stock will be in all these respects in the year 1908. And if we go on for years and give the picture for each year, you are able to give a picture of how the influence of man will affect the fish; at the same time you can also give an idea of what you are able to predict for the future of the fishermen. You get a knowledge of the great fish problems of the future. Are we to inspire the people to go on, or are we to induce them to exercise economy? And this, in my opinion, is the great basis for international co-operation.

The PRESIDENT: There is one country which I entirely forgot to mention, that is Great Britain. We have a representative here, Prof. D'Arcy Thompson; he can tell us, I am sure, something interesting.

Prof. D'ARCY THOMPSON: It is clear, from the debate to-night, that our work ranges over many sciences, and we are reminded thereby that the points where science is most interesting, where advances are most easy, where the promise of advance is greatest, are those points where one science meets another. We have heard from the several speakers how the science of statistics, the physical sciences, the biological sciences, and your own science of geography, all have their place in our programme of work, and it is where one interprets and illuminates another that new ideas emerge and new discoveries are made. Prof. Otto Pettersson, more, perhaps, than any other individual man, has shown us the way, telling us that we biologists were not doing enough as biologists, but must have the help of the physicists and must obtain an insight into physical problems before the methods of our own work could be deemed adequate and sound. It was Prof. Otto Pettersson who guided us more than any other man, by precept and example, towards this important international co-operation whose progress has been reported to you to-night, and of the results of which we hope to have still more satisfactory evidence in a little while to come.

The PRESIDENT: I think all that remains for us is to wish hearty success to the work of the International Council, presided over by Dr. Pettersson.

Prof. OTTO PETTERSSON: I think I will just say a few words on behalf of my fellow-colleagues of the International Investigation. I think the last word to be spoken to-night should be a word of thanks to the President of this illustrious Society and to the members for the hospitality they have shown to us, and for the manner in which they have had the kindness to describe our work.

GEOGRAPHY AND COMMERCE.*

By GEORGE G. CHISHOLM, M.A., B.Sc.

THE subject which I have chosen for this address is one that is very apt to raise questions that might lead to keen and even warm controversy. For the raising of such questions no occasion could be less suitable, and it will therefore be my endeavour to handle the subject in such a manner that burning questions may be altogether avoided. For that reason I propose to consider the relations of geography and commerce from an historical point of view, which at least gives one the opportunity of confining one's self to less debatable ground than is entered on when one ventures on prophecy, that "most gratuitous form of error," as it is

* Presidential Address to the Geographical Section, British Association, Leicester August 1, 1907.

styled by George Eliot. That I shall be able to keep wholly free from debatable matter is more than I can hope, but it is my intention to try to avoid it as much as possible by illustrating my subject chiefly by reference to the broad, familiar facts of commerce considered in the light of geographical and other implications that may be described as obvious—obvious, and yet perhaps not unimportant and not unworthy of having attention specially called to them; for, after all, the obvious is obvious only to those who are looking in the right direction and with the proper focus, not to those who are looking another way or far beyond what is immediately before them.

As the first of these obvious considerations, I may point out that unquestionably the foundation of commerce is the mutual advantage to be derived from the exchange of commodities produced in different places. Geographical relations are therefore of necessity implied in commerce. But those who carry on commerce have always aimed at the greatest possible advantage to themselves, and the commerce that has always attracted the greatest attention is that which has resulted in the greatest additions to their wealth. Peculiar importance therefore belongs to the geographical relations between regions which under any given circumstances lead to the most profitable exchanges.

But before applying this consideration there is another point which must detain us a little. In speaking of wealth, as I have just done, I am aware that I have made use of a term which economists recognize as one requiring a great deal of exposition to prevent misunderstanding, and there is not the slightest doubt that in the history of commerce it has led to great misunderstanding, and therefore it is necessary, without entering upon an economic disquisition on the subject, to consider the meaning of the term "wealth" sufficiently to indicate the way in which that misunderstanding has arisen. For this purpose it will be most convenient not to give one of the highly abstract definitions of wealth which a modern political economist will give us, but to go back to the more concrete considerations set forth by Adam Smith, who tells us that "the wealth of a country consists, not in its gold and silver only, but in its lands, houses, and consumable goods of all different kinds." * Now, no definition of wealth is given by economists which excludes this last form of wealth, but the misunderstanding to which I refer arises from the fact that this form of wealth is apt to be overlooked. It may happen that a country or region produces a great abundance of consumable goods in proportion to its population, and hence from this point of view be entitled to be regarded as wealthy, and yet may not be a country or region that attracts much attention by its wealth. What has always attracted attention to wealth, and what has caused wealth to have an important effect in directing the main streams of commerce, and commerce to have an important effect, direct or indirect, on history, has been the accumulation of much wealth in few hands, so that a comparatively small number of people in a community have enjoyed, directly or indirectly, the command of a great deal of labour, have had the means of providing themselves with commodious and luxurious houses, with a variety of other comforts, luxuries, and splendours, and over and above that the means of so directing labour as to add still further to their wealth. Such conditions may exist where the great bulk of the population are extremely poor.

Now, it happens that wherever a great abundance of consumable commodities is produced on a relatively small area there is always in that area a greater or smaller number of individuals in whose hands much wealth is concentrated. It is for economists to explain how this comes about, or has come about, but it is

* 'Wealth of Nations,' book iv. ch. i.

a fact of the utmost importance for geographers to bear in mind in considering the relations of commerce and geography.

The existence of a relatively dense population may be due to different causes, such as a great abundance of agricultural products, the carrying on of mining or manufacturing industries, the concentration of the administration of a great dominion, or the pursuit of commerce itself. Where it is due to any cause but the production of great quantities of the necessaries of life foodstuffs must be imported in large quantities, and where the pursuit of manufactures is the cause, or one of the chief causes, then the importing of raw materials is entailed. Where these are most advantageously found there also much wealth is likely to be accumulated in few hands.

Further, it is to be noted that where a comparatively small number have the command of much wealth there is sure to be a demand for things of such value that they can be bought only by the wealthy, things that are more or less rare, such as precious metals, jewels, gems, ivory, fine woods, ornamental skins and feathers, manufactured goods of rare materials or of fine quality, as well as, in many places and in most periods of history, slaves. Such trade is necessarily limited in amount, but puts great profits in the hands of those who carry it on with success, and for that reason attracts attention.

With this class of goods may be associated certain others that may be regarded as intermediate in position between those which are bought only by the wealthy and those which are not merely generally consumed but also very widely produced. Amongst these may be mentioned salt, the consumption of which is universal, but the production of which, away from the seaboards of the warmer latitudes, though in a sense widespread, is strictly confined to scattered spots. A more interesting example is that of spices, one of which, pepper, has from a remote period been very generally consumed, but in still smaller quantity than salt, and for that reason has been able to bear still higher transport costs. For ages these costs were very high, for various reasons, amongst which were risks both numerous and great, but the profits of those who were successful in the trade were proportionately high.

Peculiar importance in commercial geography is thereby given to the relations between the regions that yield or yielded spices and those in which they were consumed at a great distance from the place of origin, and one of the most important facts in human history is that for many hundreds of years an extremely valuable trade in these commodities was carried on between India and the Mediterranean. Spices no doubt were less talked about, less prominent as symbols of wealth, than gems and jewels, fine woods and ivory, but they formed the basis of a larger trade, which was in the aggregate probably more profitable than that in the still more costly wares.

The geographical relations between India and the Mediterranean necessarily determined the routes followed by this traffic. These routes were singularly few. They were practically confined for the most part to minor variations in two main routes, one by way of the Red sea, the other by the Persian gulf. At more than one period of history, in very early times in the days of the splendour of Assyria and Babylonia, and again in the flourishing days of the Caliphs of Baghdad, the Persian gulf route had a peculiar advantage in the existence of the large and rich populations that afforded an intermediate market; and another important fact in the relations of geography and commerce, one that has had vast effects on human history, is that the physical conditions of the area between the head of the Persian gulf and the Mediterranean are, and throughout human history have been, such as to make the most convenient outlet of that route some point or points on that seaboard which in ancient times was known as Phœnicia. Between that seaboard and

the Euphrates the desert is sufficiently narrowed to be most easily crossed. The most favoured outlets on this seaboard were not always the same. They varied in different circumstances, which gave a different geographical value now to one point, now to another. But on these variations, interesting and instructive as they are from a geographical point of view, there is no time to enter on this occasion, and it will be enough to call attention to a very interesting paper by the late Elisée Reclus, entitled "La Phénicie et les Phéniciens," dealing with this and other matters connected with the geographical basis of Phœnician commerce and industry—a paper, too, that is apt to be overlooked, inasmuch as it was contributed by him, with a generosity characteristic of one of the least self-seeking natures with which the world was ever blessed, to a rather out-of-the-way publication, the *Bull. de la Soc. Neuchâteloise de Géog.* (vol. 12, 1900). But while I do not desire to enter into details regarding the Phœnicians, it is necessary to point out how naturally, and indeed inevitably, this position of the Phœnician cities between the Mediterranean on the one hand and Mesopotamia and the Persian gulf route to India on the other hand brought other sources of wealth in its train. Conveniences for the distribution of manufactured goods have always been one of the most important advantages for the development of manufacturing industry, and the wealthier the community forming the market for the products of such industry the more valuable are the manufactures likely to be. Hence the Phœnician manufactures of fine linens and woollens richly dyed, glass and metal wares, for which other parts of the Mediterranean and its seaboard furnished the raw materials, slaves to do the manual labour, and food for that population which the narrow strip of Phœnicia could not adequately supply. Food is indeed a bulky commodity, but even bulky commodities could be transported by sea at a relatively small cost, and in connection with this traffic we must note the indirect effect which the wealth of Phœnicia must have had in promoting the settlement of districts favourably situated for supplying food, and especially of such districts where the opportunities for producing food were great, but not fully turned to account, where the supply therefore could easily be made superabundant in proportion to the wants of the population. This shows that, from the very nature of commerce, its benefits are not confined to one side. Although the geographical conditions for a long period of time led to a special accumulation of the wealth due to commerce on Phœnicia, Phœnician trade promoted the growth of wealth and civilization elsewhere. The Greeks of the Ægean distinctly recognized what they owed to the Phœnicians, and they in their turn derived much wealth from Eastern trade, even though not so directly as the Phœnicians, and they in their turn derived some of the food for a commercial population from the far West—from Syracuse, Sybaris, and even the distant Kume. But the far East had a peculiar fascination. As the articles from which much of the wealth of commerce was derived originally came from India, it was natural that the idea should arise that India was a wealthy country, a country well worth possessing. I am not aware whether India ever was in historical times a wealthy country in the sense of producing a great abundance of the necessaries and ordinary conveniences and comforts of life in proportion to the population, but if it was not rich itself it was at least the means of making others rich. There can hardly be a doubt that the desire of possessing this country of real or imagined wealth was prominent among the motives that led Alexander the Great to embark on that enterprise which had such surprisingly—one might almost say miraculously—widespread, profound, and lasting effects on the history of the near East. If we may accept as historical the speech in which Quintus Curtius represents Alexander as having addressed his troops after his victory over Porus, in order to encourage them to advance further into India, that speech affords fairly strong evidence of what has just been stated. "What now

remained for them," said Alexander, "was a noble spoil. The much-rumoured riches of the East abounded in those very regions to which their steps were now bent. The spoils accordingly which they had taken from the Persians had now become cheap and common. They were going to fill with pearls, precious stones, gold, and ivory, not only their private abodes, but all Macedonia and Greece." * Alexander was no merchant. Pepper was beneath his notice. His symbols of wealth are those which have always most powerfully affected the imagination. Later on, however, we shall meet with a king who was a merchant, and who understood perhaps better than Alexander wherein consisted the value of Indian trade.

At the outset of his career Alexander had destroyed Tyre, thinking, no doubt, that he had thereby wiped away the claims of one rival for a share of the wealth of the East; but it is a noteworthy fact that he did not thereby destroy the value of the site of Tyre under the conditions which then subsisted. Tyre revived, and again obtained wealth from its trade with the East, as it did again and again in subsequent history. A heavier blow to Tyre than its mere destruction was the ultimate accomplishment of Alexander's idea for founding a great seat of commerce on the harbour which he saw could be created in the neighbourhood of the Nile delta. The foundation of Alexandria and the successful efforts of the successors of Alexander in Egypt to divert a large part of the trade in spices and other Oriental goods to the Red sea route for the Mediterranean did more than a single act of war to deprive Tyre and other Phœnician cities of the peculiar pre-eminence which they had long enjoyed in the trade in those wealth-bringing commodities.

But perhaps the history of Venice shows even more clearly than that of Tyre the importance of this Eastern trade in connection with certain inevitable geographical relations. The foundation of the future commercial glory of Venice may be said to have been laid when Rome planted her colonies north of the Po. The gradual clearing of forests gained for agriculture to a greater and greater extent one of the most favoured agricultural areas in Europe. There resulted a superfluity of agricultural products, which begot a trade by sea. The great outlet of this plain in Roman times was Aquileia, which, in the beginning of the fifth century, when no one of discernment could imagine that there would ever be other than Roman times, was described by a Roman man of affairs and minor poet as one of the nine great cities of the world. But before that century was out Aquileia was destroyed, never to recover. The value of its site was replaced, and that in a strange way, which no man of discernment could ever have foreseen. The time that saw the destruction of Aquileia and the times that immediately followed were such as made safety a prime consideration, and especially for all who possessed or desired to possess wealth. Refugees from Aquileia, and afterwards from other Italian cities, thought at first of nothing but safety. Many of them found it on a few muddy and sandy islands near the muddy shores of the lagoon in which Venice now lies. But here they found the means of trade. The sea could be made to furnish both fish and salt, and the rivers that flowed into the lagoon enabled them to exchange these commodities for provisions of other kinds, which the adjoining land could supply. Gradually this commerce grew, until in the eighth century we find the Venetians trading with Syria and Africa, Constantinople, and the ports of the Black sea.

Throughout the period of growth the policy of this trading republic, both by land and sea, is very significant. Venice early realized the force of Bacon's maxim "that he that commands the sea is at great liberty, and may take as much and as little of war as he will." Power at sea was necessary to provide security for her

* J. W. M'Crindle, 'The Invasion of India by Alexander the Great' (1893), p. 215.

commerce. In early times she generally owned allegiance to the Eastern Roman Empire, a suzerainty which could do her little harm and could and did do her much good. To that allegiance she adhered until she was strong enough to turn against and reap advantage from the overthrow of her suzerain. At an earlier date, before the close of the tenth century, she had conquered Dalmatia, and thereby destroyed the hordes of pirates who had found refuge in the innumerable harbours of that coast and constantly harassed the commerce of the Adriatic. At every opportunity she secured establishments and acquired possessions in the Levant.

On the land side, however, dominion would have added more to her risks than her advantages, and that dominion was not sought. For more than eight hundred years after the first flight to the islands of the lagoon, more than six hundred after the election of the first Doge (697), Venice possessed no territory on the mainland beyond a mere narrow ribbon on the edge of the lagoon. The nature of the situation made her indispensable to the trade of the land immediately behind. An incident belonging to the close of the ninth century illustrates the force of this observation. A keen dispute had arisen between the Patriarch of Aquileia and the Patriarch of Grado. Venice supported the Patriarch of Grado, and war seemed to be threatened. But so necessary had the commerce of Venice become to the inhabitants of the territory acknowledging the authority of Aquileia, that in order to bring about the submission of the Patriarch of Aquileia it was enough to close or blockade the port of Pilo, on the mainland opposite the *lidi*. The subjects of Aquileia then forced the patriarch to sue for peace.* On another occasion, in a dispute with the Bishops of Belluno and Treviso, the matter was again partly settled through the efficacy of the measures taken by the Doge Orseolo II., with the consent of the people, to stop commerce with the territory of the bishops, by which the inhabitants found themselves without supplies of salt, and without the means of exchanging their leather and meat for Venetian wares or selling the abundant timber of their forests for the building of Venetian ships.† In holding the outlets for maritime commerce Venice felt herself to be in the possession of "the keys of trade," to use the expression employed by Sir William Petty in speaking of the analogous position of Holland in later times at the mouths of the Rhine, Meuse, and Scheldt.

But while possession on the mainland was not necessary to Venice, she always recognized and sought the advantage of good relations with the occupants of the plains behind her, whoever these occupants might be, and on every occasion endeavoured to turn to her own benefit the vicissitudes of those plains. In her early days she is found now in alliance with the Greeks, now with the Pope, now with the archbishops of Ravenna, and now with the Lombards, just as it happened to suit her interests, and in any case taking every opportunity of obtaining direct and indirect advantages from trade with the most profitable customers in the plains. When famine pursued the steps of the Lombard invaders of Italy in the sixth century, "the Venetians in their pacific retreat," says Mutinelli, ‡ "could send their ships to the ports of Apulia and elsewhere to obtain victuals and corn for the famished barbarians," and in consequence the Lombards took them under their protection and granted them security and favours throughout the Lombard kingdom. When Charlemagne, at the invitation of the Pope, invaded Italy to deliver the Church from its subjection to the Lombards, Venetian traders promptly

* Romanin, 'Storia documentata di Venezia,' vol. 1, pp. 197, 198.

† *Ibid.*, pp. 270, 271.

‡ 'Del Commercio dei Veneziani,' p. 12.

appeared in the camp of the Franks at Pavia and sold to the Frankish chiefs all the riches of the East—Tyrian purples, the plumage of gay birds, silks, and other ornaments, pranked in which the purchasers stalked about in their pride, feeling, no doubt, that now at last they had conquered a land whose wealth would reward all their labours and hardships.* Charlemagne, it is true, was inclined to look with little favour on the Venetians, whom he regarded as supporters of the Greeks, but an attack by his son Pepin in 809 on the islands of the lagoon only served to establish the strength and security of their position, at least on the inner islands of the lagoon. By closing the passages of the canals, removing the navigation beacons, and fortifying and barring the chief entrances to the land, they succeeded in holding out during a siege of six months, till the heats of summer began to decimate the troops of Pepin, who, on hearing also of the approach of a Greek fleet, came to terms with the Venetians on conditions similar to those which had been maintained with the Lombards. The Venetians agreed to a tribute, but solely for the narrow strip of territory held on the mainland and in return for commercial privileges in the Frankish dominion, not for any recognition of the existence of the State. The tribute was afterwards paid or withheld according to the power which the emperors showed of enforcing it; but one permanent result of this incident was that the Venetians, perceiving the smaller security belonging to the islands nearer the mainland, of their own choice made the Rialto the capital of their little State † (810).

As a last illustration of the nature of the relations of Venice to the North Italian plains, we may refer to some of the points mentioned in a celebrated and often-quoted address delivered to the principal senators of Venice by the Doge Mocenigo just before his death (1423), at the time at which Venetian trade was at the very height of its prosperity. At that time Venice was in possession of a considerable tract of adjacent territory on the mainland, and there was a party favourable to further action on the part of Venice against the growing power of Milan. The aged and sagacious Doge feared that this party was going to gain the upper hand and elect as his successor Francesco Foscari, who, he thought, would involve them in dangerous and disastrous as well as useless enterprises. The immediate occasion of the conflict of views in the Venetian Senate was a request of the Florentines for support against alleged designs of the Duke of Milan. Moncenigo, however, not only warned the senators in the most earnest and urgent language against Foscari personally, but also advised them against the particular enterprise, maintaining that it was of no consequence even if the Duke of Milan made himself master of Florence, since the artisans of Milan would continue to send their manufactures to Venice, and the Venetians would be enriched to the loss of the Florentines. He then went on to give particulars of the trade of Venice at that time, dwelling specially on the value of that with Lombardy. To Lombardy alone, it appears, Venice sold every year cloths to the value of 400,000 ducats, *tele* (? linens) to the value of 10,000 ducats, wools of France and Spain to the value of 240,000 ducats, cotton to the value of 250,000 ducats, wine to the value of 30,000 ducats, cloth of gold and silk to the value of 250,000 ducats, soap to the same value, spices and sugar to the value of 539,000 ducats, dye-woods to the value of 120,000 ducats, other articles 110,000 ducats: in all, goods to the value of more than 2,500,000 ducats, the profit amounting to quite half a million ducats. With the exaggeration that comes natural to a lover of his country, Mocenigo goes

* 'De rebus bellicis Caroli Magni,' L. iii., quoted by Romanin, as above, vol. 1, p. 130.

† Romanin, as above, vol. 1, pp. 144–149.

on to say rather grandiloquently that to the Venetians alone land and sea were equally open; to them only belonged the carriage of all riches; they were the providers of the entire world.

All this trade, as well as that of Genoa and other Italian ports which shared with others in the spice trade, must have had a remarkably fructifying effect in North Italy generally. Agriculture and manufactures would be alike promoted, and in consequence of that the growth of population; and when war, with its attendant scourges, led to a diminution both of industry and population, this commerce could not fail to assist in bringing about a speedy recovery. It has already been hinted that in manufactures both Milan and Florence took a prominent place in the time of Mocenigo. In truth, manufactures in both cities are of much older date, and it may be interesting to mention here that even in the thirteenth century English wool was a commodity sufficiently valuable to bear the cost of transport to Florence. A letter has come down to us,* dated London, January 6, 1284, from the representative of a Florentine house, giving particulars as to purchases that he had made—in many cases for several years in advance—of all or a portion of the wool of many English monasteries from Netley and Titchfield in Hants, and Robertsbridge, in Sussex, to Grimsby, in Lincolnshire, and Sawley, on the Ribble, in the county of York (one of these monasteries, you may be interested to learn, as near Leicester as Monks Kirby, about midway between Rugby and Nuneaton), and from the work in which this letter is published, we also get particulars † as to the cost of conveying wool from London by way of Libourne to the Mediterranean port of Aigues Mortes in the same or the following century. Florence, indeed, depended on England, Spain, and Portugal for wools of fine quality, its own and other wools of Italy being of very inferior value, so that when four bales of English wool were worth in Florence 240 gold florins, the same quantity of wool of Garfagna dell' Aquila was only worth 40 florins.‡ The author of this work adds that he has found no indication of the prices of the wools of Spain and Portugal in Florence. Besides manufacturing cloths from the raw material, Florence carried on a large trade in dressing and finishing woollens manufactured in Flanders and Brabant, and brought to Florence either by way of Paris and the Saône-Rhône valley or by way of Germany and across the Alps. In the time of Mocenigo many of these products of Florentine industry came to Venice for export. In the address already referred to, Florence is said to have sent to Venice every year 16,000 pieces of cloth, which were sold to Aquila, Sicily, Syria, Candia, the Morea, and Istria.

It will be noticed that in the address above quoted Mocenigo lays no special stress on the spice trade, but there is not the slightest doubt that spices were amongst the most important commodities with which the Venetians provided a large part of the western world. Just as nowadays the large trade of Britain in bulky goods

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* Published (1765) in a work having no author's name, but stated in the British Museum Catalogue to be by G. F. Pagnini della Ventura, and bearing the title 'Della Decima e delle altre Gravezze della Moneta, e della Mercatura de' Fiorentini fino al secolo XVI.,' the third volume of which contains "La Practica della Mercatura" of Balducci Pegolotti (ascribed to the first half of the fourteenth century), under whose name the work is entered in the British Museum Catalogue. The date of the letter is given on p. 94 of vol. 2, and the letter itself on pp. 324–327 of the same volume. For the identification of the names of monasteries in their much-disguised Italian forms and spelling, I am indebted to my friend Mr. A. B. Hinds, M.A., editor of the last-issued volume of the *Calendar of State Papers* (*Venice*). Most of them, however, are entered and identified in the list given from Pegolotti on pp. 629–641 of Cunningham's 'Growth of English Industry and Commerce, Early and Middle Ages,' 4th edit. (1905).

† *Ibid.*, vol. 3, pp. 261–263. ‡ *Ibid.*, vol. 2, p. 95.

makes of this country a great entrepôt for the more valuable and less bulky, so in Venetian times the exceptionally large population behind Venice receiving and supplying the bulky goods thus fed the shipping which brought to Venice a much larger proportion of the more valuable goods of the East than was brought to other ports. But there is plenty of direct evidence of the importance of Indian trade to Italy in the Middle Ages. It is to be remembered that of necessity this trade enriched other countries before it reached Venice, and in proof of its importance in the Mediterranean generally, one may call attention to the investigations of the Venetian Marin Sanuto Torcello about the end of the thirteenth century, who, we are told, saw with indignation that the defeats of the Christians in Palestine were specially due to the power of the Soldans of Egypt, and perceiving that their great power derived its nourishment from the commerce with the Indies, based on that observation the projects which he urged on Christendom for the overthrow of that power. It is further significant that a sea-way to India should have been sought by Genoese as early as 1291,* and even more significant that a century later Venice should have found it worth while to maintain a consul in Siam.†

But the clearest evidence of the supreme importance of the Indian trade to the Italian cities is to be found in the results of the discovery which finally diverted from Venice and the Mediterranean the great bulk of the Indian trade until that trade had lost all the special significance which it had retained for thousands of years. It need hardly be said that I refer to the discovery of the sea-way to India by the Portuguese in 1497–9. Of the feeling aroused in Venice by this discovery Romanin has reproduced,‡ from the 'Diarii' of Priuli, an interesting contemporary record, written with reference to a despatch to the Doge probably from Pietro Pasqualigo, a Venetian envoy at Lisbon at the time of the return of the second Portuguese voyage to India under Cabral. The letter is stated to have reached Venice on July 24, 1501. After giving the letter, in which we are told, among other things, how the Portuguese had charged their ships at Cochin with spices at a price which the writer feared to mention, Priuli adds: "On the arrival of this news at Venice all the city was deeply moved and remained stupefied, and the wisest held it for the worst news that could reach them. For, it being recognized that Venice had risen to so high a degree of renown and wealth solely by the commerce of the sea and by navigation, by means of which every year a great quantity of spices was brought thither, which foreigners then flocked together to acquire, and that by their presence and the traffic they obtained immense advantages, now by this new voyage the spices would be brought from the Indies to Lisbon, where Hungarians, Germans, Flemings, and French § would seek to acquire them, being able to get them there cheaply; and that because the spices that came to Venice passed through the whole of Syria and the countries of the Soldan, paying in every place exorbitant duties, so that at their arrival at Venice they were so weighted that what at first was of the value of a single ducat was raised in the end to sixty and even a hundred ducats; from which vexations, the voyage by sea being exempt, it resulted that Portugal could give them at a much lower price." So said the wisest, but it is interesting also to note what was said by the less wise. Priuli goes on: "And while the wisest saw that, others refused to believe the story [these,

* See the account of this attempt and its results, so far as they are known, in G. H. Pertz, 'Der älteste Versuch zur Entdeckung des Seeweges nach Ostindien.' Berlin, 1859.

† Romanin, as above, vol. 3, pp. 335, note (5).

‡ As above, vol. 4, p. 461.

§ We must recognize with due humility that the English are of little account in Venetian eyes in 1501.

I presume, were the least wise], and others again said that the King of Portugal would not be able to continue this navigation to Calicut, since of thirteen caravels only six had returned safe, the loss would be greater than the advantage, and that it would not be so easy to find men who would consent to risk their lives in so long and perilous a navigation; that the Sultan of Alexandria, seeing the loss of so fine a profit as that obtained by the passage of the spices through his lands, would see to that."

But in this case it happened that the wisest were right. The effects of this discovery were not long in making themselves felt in the notable diminution in the sales of spices at Venice. Under the date February, 1504, Priuli enters in his diary, "The galleys of Alexandria have entered into harbour empty: a thing never before seen." In the following month the same thing happened in the case of the galleys from Beirut.* Under August, 1506, it is stated that the Germans at the fair of the preceding month had bought very little. Various remedies for these evils were thought of, and among these it is interesting to note that in 1504 the Council of Ten seriously discussed a proposal to empower an envoy to the Sultan of Egypt to come to an agreement with him, if possible, for the cutting of a canal through the Isthmus of Suez.† But the proposal was not adopted. Other efforts to avert the results of the great achievement of the Portuguese were vain. Other disasters befel the republic about the same time. Not only was commerce taking another direction, but, says Romanin, "the wars of Italy were emptying the treasury, the Turkish power was despoiling the republic step by step of its possessions beyond the sea, and Venice was beginning to descend that incline which was to reduce it to a subordinate position among the powers of Europe." ‡ North Italy generally suffered at the same time. The withdrawal of the greater part of the spice trade, by diminishing the growth of wealth among the inhabitants, made that part of the world a less important market for manufactured goods. Countries outside of Italy, where rival manufactures had already started, were increasing their wealth more rapidly, and thus imparting an increasing stimulus to their manufactures, and these increased while those of Italy declined. In 1338 the number of woollen factories in Florence is given at 200, making in all 70,000 to 80,000 pieces of cloth in the year; in 1472 the number of shops or factories had risen to 270, but no estimate is given of the quantity of the product; in 1529, however, the number of shops is said to have sunk to 150, and the quantity of cloth manufactured to 23,000 pieces per annum, and in the time of the editor of Balducci Pegolotti the quantity was only about 3000 pieces annually.§

Before going further, however, there is one point in the comments on the discovery of the sea-way to India quoted above from the 'Diarii' of Priuli which calls for notice. Hungarians, Germans, Flemings, and French, he observes, will in future go to Lisbon to get the spices of India more cheaply than at Venice. This remark illustrates the difficulty of shifting the geographical point of view according to circumstances, a difficulty of which at all times abundant illustrations can be offered. The purchasers of spices who came first into the mind of Priuli are Hungarians and Germans. It was inevitable that they should be among the leading customers of Venice. The Hungarians were supplied from the Dalmatian ports which belonged to Venice. The Germans came by way of the Rhine and the Elbe, and then across the Alps to get supplies for central, north-western, and northern

* G. Coen, 'Le Grandi Strade del Commercio Internazionale proposte fino dal Sec. XVI.' (Leghorn, 1888), p. 71.

† Coen, as above, pp. 82, 83.

‡ As above, vol. 4, p. 466.

§ 'Della Decima,' as above, vol. 2, pp. 64, 105.

Europe. But it was neither Hungarians nor Germans who came in greatest numbers to Lisbon to buy the spices which Portuguese ships brought from the East. In any case Lisbon had no advantages like those of Venice for supplying by land a large and rich population immediately behind it. The valley of the Tagus was small and poor, and had not the capacity for expansion in wealth and population which the Lombard plains had when the commerce of Venice began to grow. The bulk of the spices brought to Lisbon had therefore to reach their final markets by routes that did not pass through Lisbon into the interior. To supply the most important of those markets it was the Dutch, the people who held "the keys of trade" for the important valleys of the Rhine, Meuse, and Scheldt, who came to Lisbon in greatest numbers to buy spices of the Portuguese. And here it has to be added that, in spite of the discovery of the sea-way to India, the Venetians continued to retain great advantages in the spice trade with Hungary and parts of Germany, as well as, of course, the northern plains of Italy. Things did not remain always as bad as recorded in the years 1504 and 1506. The Portuguese, while maintaining successfully for a hundred years the monopoly of the trade in spices at the place of origin in the East, found their advantage in dividing the trade with Europe between the sea-way and the Persian gulf route, of which latter route they held the key since the final capture of Ormuz in 1515. The trade by way of the Tigris through Baghdad (the so-called Babylon of those days) and the Euphrates to the old Phœnician seaboard was again revived, and was maintained as long as Portugal held command of the trade. It was by this route that the first English commercial expedition to India, that of Newberie, Leedes, Story, and Fitch, went out in 1583, and by which Ralph Fitch, the sole survivor of that expedition, returned in 1591. By this route Venice got back some of her spice trade; not perhaps with the same profit to herself as formerly, but still a trade of no slight importance, not only to Venice, but also to Augsburg, Nuremberg, and some of the other cities of South Germany.

But beyond doubt the bulk of the trade was now carried on by the sea route, and we are thereby enabled to get a better idea both of the amount and the nature of the trade. On both points we get information from the 'Narrative' of the above-named Ralph Fitch, who tells us that "the Fleete which commeth every yeere from Portugal, which be foure, five, or sixe great shippes, commeth first hither [to Goa]. And they come for the most part in September, and remaine there forty or fiftie dayes; and then go to Cochin, where they lade their Pepper for Portugall."* Now, in 1583 a ship of 500 tons would certainly be called a great ship. In 1572 the largest vessel sailing from the port of London was of 240 tons,† and the largest of the first fleet of the East India Company was one of 600 tons. I could give more definite information as to the capacity of these fleets at that time if I knew exactly what a *salma* was, for in a report on Portuguese trade sent to the Grand Duke Ferdinand I. of Tuscany (1587–1608) we are told that the fleet consisted of four or five carracks of the capacity of 5000 or 6000 *salme*.‡ But a *salma* is a term for which one sometimes gets a very indefinite meaning, at other times definite but very diverse meanings, sometimes a weight of 25 lbs. which is obviously too little, and again a weight of 1000 lbs., which is probably too much. The large dictionary of Tommaseo gives this latter weight with an example stating the capacity of a ship; but if that were the meaning then the carracks would be of a burden of from 2250 to 2700 tons, a much heavier tonnage than is elsewhere indicated, so far as I am aware, for

* Horton Ryley, 'Ralph Fitch,' p. 61. † *Ibid.*, p. 17.

‡ Angelo de Gubernatis, 'Memoria intorno ai viaggiatori Italiani nelle Indie Orientali dal secolo XIII. a tutto il XVI.,' p. 149.

vessels of the period. Probably 3000 tons would be the outside limit of the aggregate cargoes annually brought to Portugal, for in any case much room in the ships was required for the large crews of those days with their armaments, for then the idea of carrying on commerce by sea without being in a position to defend your ship was out of the question.

Of the commodities sent home from India, Fitch mentions in this place only pepper, and the correspondence of Albuquerque with the King of Portugal soon after the discovery of the sea-way to India clearly reveals how all-important the pepper trade was; but it may be worth while to give the complete list of the commodities which Ralph Fitch enumerates at the end of his 'Narrative' as coming from India and the country further eastward. The list is not a long one. It comprises pepper, ginger, cloves, nutmegs, and maces, camphora ("a precious thing among the Indians . . . solde dearer then golde"), lignum aloes, long pepper, muske, amber, rubies, saphires, and spinels, diamants, pearles, spodium, and many other kindes of drugs from Cambaia—all of them, it will be observed, having the character of being of high value in proportion to their bulk, so that a very great value of such goods might be carried in ships of small capacity.

Fitch does not tell us what was sent in return, but information as to that is to be had from other sources and presents one or two points of interest. In 1513 Albuquerque, after a long course of fighting, concluded a peace with the Zamorin of Calicut, in which it was agreed, among other things, that the Zamorin should supply the Portuguese with all the "spices and drugs" his land produced, and that "coral, silk stuffs, quicksilver, vermilion, copper, lead, saffron, alum, and all other merchandise from Portugal," should be sold at Calicut as heretofore.* Coral comes first in this enumeration. To us at the present day this does not seem a very important article of commerce, but it was otherwise then. One Mafio di Priuli, writing from India in 1537 to the Magnifico M. Constantino di Priuli, says, "At a great fair which is called that of Tremel I have seen buttons of coral sold for their weight in silver." † That is the point of view of a European in India, but a native of the East Indies in Europe at the same date would no doubt have spoken with astonishment of the amount of silver that could be got in Europe for a few grains of pepper. Our letter-writer says in his cheerful, hopeful, gossiping way, "The gains of these parts are other than those of Damascus, Aleppo, and Alexandria: for if one does not gain cent. per cent. from Portugual here, and from here back again, one thinks that one gains nothing. And three or fours years would be quite enough." ‡ But, while he indicates how these immense gains are made, he also indicates clearly enough how they continue to be made—that is, how they are so counterbalanced by losses that if these great gains were not made on occasion commerce would cease. It was all very well to exchange your coral for spices, but the great matter was to get your coral out and your spices home in safety. The writer of this letter had entrusted to a friend who had left on a ship for Ormuz jewels of the value of 4000 Venetian ducats, but the jewels were lost. He believed that his friend was murdered. "But such losses," he adds, "will occur." Another time he lost more than 6000 ducats gold in Portuguese vessels going to Ormuz, and on another occasion he suffered great loss when Pegu was sacked by the King of Burma.

These notes may serve to illustrate the conditions of trade in the glorious days for Portugal when fine fortunes were heaped up in Lisbon through trade, but the

* Danvers, 'The Portuguese in India,' vol. 1, p. 283.

† P. 34 of the letter referred to as published at Venice in 1824.

‡ *Ibid.* p. 29.

great bulk of humanity got very little at least directly through that trade; but we have not exhausted the interest connected with the nature of the outgoing commodities for India, and to that it will be well to return. Another of the stipulations of the treaty of 1513 above referred to was, that while duties were to be paid in coin "the Portuguese were to pay for all the pepper and other merchandise they might purchase in kind," and, as the peace led among other things to a dearth of prizes, Albuquerque "was constrained to send an urgent request home for large quantities of merchandise to be sent out to make up for this deficiency." * How long this stipulation remained in force I cannot say, but things were certainly different a hundred years later. In the report to the Grand Duke of Florence above cited we are told that what the Portuguese carry to India for exchange is above all "silver in reals, and besides silver wine, oil, and some other sort of merchandise, such as coral, glass, and the like, of little importance;" and as to the silver, he adds that "the reals bring a gain of more than 50 per cent. as soon as they have reached India, for the real of eight, which in Lisbon is worth 320 reis, in India is sold and spent at the rate of 480 to 484 reis of that money, and with it one buys all sorts of spices and drugs which are sold there, except pepper, which is the monopoly of the King of Portugal and those to whom he gives a lease of that trade." The importance of silver among the outgoing commodities for India has continued from that time down to the present day, latterly, however, in diminishing proportion. For a long time after the date at which we have now arrived it was as predominant as a means of exchange with India as it was in the first century of the Christian era, when the drain of silver from the Roman Empire to the East was bewailed by the writers of that time. In the voyages of the English East India Company of the four years 1620-23 inclusive, the value of the bullion (chiefly silver) sent out to India was £205,710, as against only £58,806 worth of merchandise.†

Now, what is the meaning of the change in the position of silver in Indian trade which seems to have taken place between 1513 and the end of the sixteenth century? No doubt we may see there the result of another change in geographical relations brought about by a discovery nearly contemporaneous with that of the sea-way to India—namely, that of the New World. The first result of that discovery of importance to commerce was the pouring into Europe of large quantities of the precious metals, and the quantity was enormously enhanced after the silver-mines of Potosi, in Upper Peru (as it was then called), were discovered in 1545. It was probably this discovery that brought it about that of all commodities of such small bulk in proportion to their value as to stand the costs of transport to the East this was the one which could be sent out for most part with the greatest advantage. And this discovery no doubt also helps to explain why that of the sea-way to India had so little effect for a very long time in lowering the prices of spices in Europe, why prices even rose. At the time of the return of Vasco da Gama from the first voyage to India the price of pepper at Lisbon is estimated by Danvers ‡ to have been about 1*s.* 5*d.* per pound, and we all know that the immediate occasion of the foundation of the English East India Company about a hundred years later was that the Dutch suddenly raised the price of pepper against the English from 3*s.* to 6*s.* and 8*s.* per pound.

But the particular commodity which made up the principal portion of the outward trade to India is, after all, a matter of detail, though not unimportant

* Danvers, vol. 1, pp. 284, 286.

† I take these figures from p. 6 of the appendix to P. Colquhoun's 'Treatise on the Wealth, Power, and Resources of the British Empire,' 2nd edit. London, 1815.

‡ As above, vol. 1, p. 64.

detail. The main point on which I want to insist is that, whatever the commodities were, whether carried out or home, the nature of the trade with the East was little if at all altered by the discovery of the direct route to India by sea. The trade still continued to be one concerned in a moderate number of articles of small bulk but high value. It was merely a change of route that the Portuguese effected, and for more than a hundred years they remained in sole command of this route. After that, however, they were ousted from the greater part of this trade, and that the more valuable part, chiefly by the Dutch, and from a geographical point of view it is very interesting to note how the Dutch did it. They did not trouble themselves much about India proper. They left the Portuguese alone at Goa, and from that port as a base allowed them to pick up as much trade as they could at Calicut and Cochin, which, said Albuquerque, "were capable of supplying the Portuguese fleets until the day of judgment." But Malacca, on the straits of that name, gave command of the route to the further East, whence came in the end even larger quantities of pepper than could be got from India; whence came too ginger, cloves, and nutmegs, as well as the products of China. The importance of this place Albuquerque had accordingly recognized, and in 1511, the year after he took Goa, he took it also by the right that always belongs to the lion as against the jackal. This place was taken by the Dutch (1641), who had previously established themselves on Java and the Spice islands, where they maintained an absolute monopoly. Ceylon, again, was (and is) almost the only place from which the true cinnamon was to be obtained, so the Dutch took that island also from the Portuguese (1656). As long as the Portuguese were the sole Europeans in the East, Calicut and Cochin not merely furnished the Portuguese with Indian wares, but were important entrepôts for the spices, perfumes, drugs, and jewels of the Further East as well as of Chinese silks and porcelains; but the trade in these commodities could be wholly or largely diverted to places in the possession of the Dutch. Even before the capture of Malacca and Ceylon a Portuguese viceroy had reported (1638) that the Dutch had a monopoly of trade from the Bay of Cochin China to the point of Sunda.

But this change also was little more than a change of route. The general character of the Eastern trade remained the same. The English East India Company, whose operations, through the hostility of the Dutch, came to be restricted to India proper, there founded a trade that gave much more opportunity for expansion under modern conditions than that of the Dutch, but for a long time it retained the same character. All the commodities enumerated by Colquhoun as brought back by the voyages of 1620–3 in exchange for the bullion and merchandise sent out were pepper, cloves, mace, nutmegs, Chinese and Persian raw silk, besides calicoes, the sole manufactured article, and one of course that had relatively a much higher value than now, when the direction of the trade in that commodity is reversed.

A similar character for a long time belonged to the trans-Atlantic trade, even though the costs of transport in that case were less, and favoured the development of a trade in somewhat bulkier commodities. Furs from the Far North, tobacco from Virginia, sugar and afterwards coffee and cotton from the West Indies, were by far the most prominent imports. It was the tobacco trade of Virginia that first enabled Glasgow, which at the time of the union of the English and Scottish Parliaments was an insignificant town with less than 13,000 inhabitants, to convert itself into a seaport, and thus lay the foundations of its subsequent prosperity. Now tobacco makes up less than 1 per cent. of the value of the goods imported at Glasgow, and though that may be partly due to a diminution in the actual quantity of tobacco imported at Glasgow, this result has chiefly been brought about by changes in relative values. A hundred years ago the value of the imports into Great Britain

and Ireland from the British West Indies was about one-fourth of the total value of the imports from all parts; now it is less than 1 per cent. of that value.

What has brought about such changes, what makes the essential difference between recent and all previous commerce, is the series of enormous improvements in the means of communication which followed so closely on the invention of textile machinery, and the improvement of the steam-engine in this country. These improvements have had two important effects on commerce. First, they have facilitated the maintenance of order and security both by land and sea, and thus enormously reduced the risks of commerce. Secondly, they have directly lowered the cost of transport for different goods in different degrees. Bulky goods of little value could now for the first time be profitably conveyed many hundreds of miles by land to a seaport, and there load ever larger ships for distant shores, thus opening up markets with vast undeveloped resources in the heart of great continents. Along with these bulkier goods the more valuable goods are carried at a cost far below that of former times, so that for such commodities as pepper the mere freight is almost a negligible item.

At the present day there can be no doubt that in point of quantity the spice trade is much larger than it ever was. If Venice could get the whole of that trade into her hands, a thing which she never had, notwithstanding the patriotic boast of Doge Mocenigo, the trade would not now bring her a tithe of the wealth which it brought in the days of her grandeur. Much has been said of the sudden "fall" of the Portuguese and Dutch in turn, and that fall has often been explained by mistakes in method. "The fall of the Dutch colonial empire resulted," says Sir William Hunter, "from its short-sighted commercial policy. It was deliberately based upon a monopoly of the trade in spices, and remained from first to last destitute of sound economical principles."* But one may well ask, Did the Dutch ever fail in a manner for which they were in any way responsible? It is true that the Dutch East India Company did not supply as many people as they could with the spices of which they held the monopoly. But that was not their aim. It is true that they did not build up a great empire like that of the English East India Company. But neither was that their aim. Their aim was to declare dividends, and dividends they declared. The profits of the company down to 1720 averaged 20 per cent. per annum, never sinking below 15 per cent., and sometimes rising to 50 per cent. If spices ceased to enable them to declare such dividends, that was not their fault. It was James Watt, George Stephenson, William Symington, and Robert Foulton, who, without intending it, and without being able to foresee what in this respect they were destined to do, sucked the value out of pepper, and that in a manner which neither the strength of armies nor the subtlety of statesmen could have done anything to prevent.

Now the countries that offer the most attractive markets for the greatest quantities of goods of all kinds are no longer those which look to the spice trade or to trade in any specially valuable commodities for their enrichment, but those which abound in coal, so placed as to develop a great amount of manufacturing industry, an industry engaged for the most part in working for the million, not merely in producing the luxuries of the rich. The commodities of very small bulk in proportion to their value now have a comparatively insignificant place in commerce. The precious metals and precious stones still, indeed, retain a good deal of their former importance. But very few vegetable or animal products can be put in the same category. Rubber, indeed, may be reckoned as one, and very handsome

* *Imperial Gazetteer of India*, 2nd edit., vol. 6, p. 362.

profits are reaped from some rubber estates. But every one knows that such exceptional profits can be reaped only for a short time. Of animal products, ornamental feathers are the most valuable in proportion to their bulk. Egrets' feathers, I believe, are seldom worth less, and often worth a good deal more, than twice their weight in gold, but ornamental feathers altogether make up less than a third of 1 per cent. of the total value of British imports.

Perhaps the greatest feature of modern commerce is the unparalleled manner in which it has promoted the increase of population nearly all the world over. Rendering it possible for manufacturing and commercial peoples to depend in a very large measure for their very means of subsistence on supplies brought from the ends of the Earth, it is rapidly pushing the settlement of vacant land to the base of the mountains and the edge of the desert. Fifteen years ago Professor Bryce said, "We may conjecture that within the lifetime of persons now living the outflow from Europe to North America will have practically stopped."* We are at least nearing the time when the "new lands" of this Earth in the temperate zone will all have been allotted. The results of such a check to expansion after a long period of stimulation to expansion must be momentous, but what the nature of these results will be I for one confess that I am unable to foresee. I am, however, convinced that, if we are to be enabled to make any probable forecast as to the course of future development, one of the most important aids to that result must consist in the study of the relations of geography and history from the point of view which I have endeavoured to indicate. To study these relations merely with reference to the immediate causes and effects of wars and treaties gives little real insight into the working of geographical influences in history. As in the study of the human body medical men have recognized the necessity of ascertaining with the aid of the microscope the normal functions of the cells of which the body is composed, the pathological states that interfere with their normal working, and the effects on one part of the body of minute disturbances of function in another part, so in tracing the course of history it is becoming more and more recognized that the minute gradual silent changes must be inquired into and taken into account, not merely in relation to the regions in which they take place, but in relation, it may be, to regions far distant. Such studies, it is true, are not confined to the geographer. In them, indeed, the geographer must seek the aid of workers in other fields; but there can hardly be a doubt that it must help greatly towards arriving at a sound solution of the problems presented to keep steadily before one the geographical point of view. The field for such studies is, of course, immense, the material perhaps not all that could be wished; but I can imagine no task more delightful for those who have the opportunity to engage in it than that of seeking out and examining from that point of view such material as actually exists.

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* "The Migration of the Races of Men considered Historically," in the *Scottish Geographical Magazine*, 1892, p. 419.

REVIEWS.

EUROPE.

Geography of Europe.

Europa.' Zweite Auflage des von Dr. A. Philippson und Prof. Dr. Ludwig Neumann verfassten Werkes, neu bearbeitet von Prof. Dr. A. Philippson. Pp. xii., 751 (including 33 pp. of index). Leipzig and Vienna: Bibliographisches Institut. 1906.

Grundzüge der Länderkunde.' By Dr. Alfred Hettner, Ordinary Professor of Geography at the University of Heidelberg. First volume, 'Europa.' Pp. xvi., 737 (including 41 pp. of index). Leipzig: 1907.

L'Europe (moins la France) au début du XX^{e} Siècle. By M. Fallex and A. Mairey. Pp. 624 (no index). Paris: 1906.

This new edition of the volume on Europe belonging to the *Allgemeine Länderkunde*, edited by Dr. Wilhelm Sievers, is in a large measure entitled to be regarded as a new work. The text is increased from 618 to 710 pages, exclusive not only of the index, but also of 17 pages of bibliography, which forms a new feature in this edition. Moreover, the first edition had nine pages devoted to the Caucasus, which is now assigned to the volume on Asia, so that the additional matter in this edition extends to quite a hundred pages. The contents are also in a large measure rearranged, recast, and rewritten, and every page of the book bears witness to careful revision. Some of the rearrangement is altogether to the good. This may be said unhesitatingly of the general introductory section, which now extends to 137 pages instead of 22 pages, as in the previous edition—an extension, however, not wholly due to the introduction of new matter, but largely to the transference to this general introductory survey of the sections (all ably rehandled) on climate, vegetation, animal life, the inhabitants, and commercial intercourse, all rather awkwardly introduced in the previous edition in other parts of the volume. In the former edition, for example, the general considerations as to climate came after the treatment of the different sections into which Europe was divided from a physical point of view, in each of which there were brief isolated notes on climate; and the section on commercial intercourse came at the end of the whole book so far as it related to inhabited Europe. Now this introductory survey forms a methodically arranged and extremely interesting whole, leading up to the section on commercial intercourse as its culmination, for Dr. Philippson holds that commerce is the most important instrument which the people of Europe make use of in attaining the goal towards which, if we may judge from the course of recent history, they are powerfully steering, the Europeanization of the whole Earth (p. 113).

The rearrangements made in the rest of the volume are not so satisfactory. In this portion of the book one would like to have had either rather more or rather less rearranging of the contents. In the former edition, Europe is first treated from a physical point of view in different sections and subsections, and the countries of the continent are afterwards treated separately in regular order as political entities. In the present edition Dr. Philippson has proceeded otherwise. He has in a large measure adhered to the divisions and subdivisions of the previous edition. All Europe is first divided into three great divisions: first, the region of the South European Folded Mountains; second, the North-West European Schollenland; and third, the Russo-Scandinavian Tableland (*Tafel*). The first of these divisions is subdivided into six sections, entitled respectively, the Alpine Lands, the Carpathian Lands, the Balkan Peninsula, the Greek Peninsula and the associated islands (including some islands belonging politically to Asiatic Turkey), Italy, and the Pyrenean Peninsula. There

are similar subdivisions of the areas included under the two other great headings. But amidst this physical matter Dr. Philippson has intercalated, either in separate sections or otherwise, all that is usually included under the head of political geography, and the results are in many cases quite as awkward as was the arrangement of much of the general matter in the previous edition. In some cases the problem presented is simple enough. Thus, after the physical geography of France has been treated in various subsections under the general heading of *Das französische Schollenland*, a separate subsection is devoted to the French Republic. But from the table of contents we cannot learn that Belgium, the Netherlands, Turkey, Servia, and other countries are treated of as countries at all. Belgium, for example, is found under the general heading of the Middle German Mountain-sill in a subsection following two others dealing respectively with the Rhenish Slate Mountains in Belgium and the Belgium Middle and Low Lands, and Holland similarly in a subsection under the general heading of the North German Low Plain. The treatment of the minor German states is found scattered over the section bearing the heading of the German Schollenland, but at the end of that section subsections are added dealing with the kingdom of Prussia and the German Empire, the latter of which is also treated in the preliminary survey of the section, where we have a map of the empire. This preliminary treatment is referred to as a section on the *Weltlage* of the empire, but it is in reality a brief but illuminating sketch of the history of the German Empire (old and new). In the circumstances indicated, Austria-Hungary fares even worse than the German Empire. What is said about Vienna is introduced into a subsection headed the Alps East of the Brenner line. There follows another subsection entitled the Economic Condition (*Kultur*) and Population of the Eastern Alps, in which Vienna is only incidentally named. The kingdom of Hungary gets a subsection under the Carpathian Lands, but there is no general treatment of the Austro-Hungarian Monarchy and of Cisleithania till after the consideration of a portion of the German Schollenland 250 pages further on. The truth is that, while the general survey is an admirable exposition, the interest of which is maintained throughout by keeping the treatment in due subordination to the geographical idea, the treatment in the remainder of the work gives too much prominence to the geological idea. The interest is consequently divided, and though the individual sections are all handled in a masterly manner, showing fulness of knowledge, insight, and lucidity, yet they do not combine satisfactorily into a consecutive whole. Like the first edition, this volume is well furnished with maps (all carefully revised and where necessary redrawn) and other illustrations.

Hettner's 'Europa' is another excellent work. It inevitably challenges comparison with that of Dr. Philippson. In extent it is about one-seventh smaller, due allowance being made for differences in the size of page and in the type; for while Philippson's book is printed in the ordinary German letter, Hettner's is printed in what we call Roman characters, and the Germans call *antiqua*. Like Philippson's book, that of Hettner is well illustrated, both with coloured plates and with text cuts in black and white; but whereas in Philippson the majority of the illustrations are pictorial, in Hettner they are all maps or diagrams. It should be added that they are nearly all remarkably well chosen or constructed, the only fault to find being that some are on too small a scale to be sufficiently clear. As in Philippson, the general account of the continent, which, under the headings of Situation and Extent, Structure and Surface, Inland Waters, Seas, Climate, etc., extends to 106 pages, is throughout excellent, though exception may perhaps be taken to the placing of the section on Races and Peoples after that on Historical Development, the result of which is that on p. 51 we meet with the Indo-Germans, or Aryans, as a "primitive people" (*Urvolk*), although it is not till p. 60 that we get a definition

of a "people" (*Volk*) as distinguished from a race. But the chief distinction between the texts of the two works is to be found in the arrangement of the subdivisions. Dr. Hettner expounds the principles on which he has proceeded in this respect on pp. 105-106. He aims at something more scientific than the division according to states and provinces usual in text-books and school-books. He considers, however, that to make one's main divisions depend on the tectonic structure and morphology leads to results that are intolerable. Cornwall and Brittany belong structurally and morphologically to the same whole; so, too, do the Paris and London basins; and Schoonen, from this point of view, belongs, not to the Scandinavian peninsula, but to the Central European *Schollenland*. Divisions based on hydrography, climate, plant distribution, etc., are also rejected. The most convenient principle of division to adopt is, the author considers, the more or less complete separation of lands by the sea, or, failing that, by high mountains like the Alps and Pyrenees. Where the sea is the severing agent, we get land-units with special relations to the surrounding seas, and with a distinctive nature and population. Where mountains are the means of separation, the division is not so satisfactory. Districts which are in many respects one are thereby rent asunder; but this is an unavoidable evil, the degree of which can be mitigated by treating the mountains as a whole in connection with one or other of the land-areas thus separated. In any case, by following these general principles, we get something answering on the whole to the usual divisions of Europe. The British Isles, the Scandinavian peninsula, and Finland, together with the Kola peninsula, form a north-western zone. A middle zone is formed by other three sections, France, Central Europe (Germany with the adjoining countries, except Russia and Hungary), and Eastern Europe; and the Iberian, or, as Hettner calls it, the Spanish peninsula, Italy, Hungary with Transylvania, the Balkan peninsula, and Greece, form a south-eastern zone. The so-called zones, however, merely indicate the order of treatment. The special treatment is under the headings enumerated, under each of which there is first a general survey, to a large extent under the same headings as those used in the account of the continent as a whole, and this gives the opportunity of dealing with political units as such. Thus, in this general survey under Central Europe (*Mittel-Europa*), there is a section, headed "The States," divided into sub-sections on the Historical Development, Denmark, Belgium, the Netherlands and Luxemburg, the German Empire, Switzerland, the Austro-Hungarian Monarchy, and Russian Poland. After this general survey there is in each division a number of subdivisions, again largely based, as regards the great groups of natural districts (*Natürliche Landschaften*), on different relations to the sea—partly, also, in some cases, on separation by the sea; and it is only in these natural districts, the smallest divisions separately treated, that differences in inner structure and in phenomena dependent thereon—that is, tectonic and morphological differences—are taken primarily into account in forming the divisions. Whether in the larger divisions and subdivisions Dr. Hettner has always quite succeeded in carrying out his general principles may perhaps be doubtful, but the general result is on the whole satisfactory. Geology is throughout placed in due subordination to geography, and towards bringing about this result nothing seems to have contributed more than the final rule above mentioned—that of basing only the smaller units, which are made the subjects of detailed description, on tectonic and morphological considerations. There is no space to draw attention to any special features in Dr. Hettner's work, but it may be well to note a few errors for correction in the next edition. By some slip the date of the loss of the English North American colonies is given (p. 75) as 1789 instead of 1776, or at latest 1783 (the year of the peace). On p. 75 reference is made to Mongol invasions of Europe in the twelfth century, which is surely anticipating events. On p. 131 Ersk appears

for Esk; and on p. 125 there is the very natural and plausible error of "Carrantuo hills," an error which would have been avoided if Dr. Hettner had met with the name in writers who prefer the simpler spelling Carntual to the lengthier, more difficult, and more misleading Carrantuohill. Further, the map of the coalfields of Great Britain on p. 110 ought not to have been given without some further annotation. It is a reproduction on a small scale of that given in the fifth edition (1905) of Hull's 'Coalfields of Great Britain,' distinguishing the areas of visible coalfields, those in which coal is believed to exist at a depth of 1000–2000 feet, and the supposed coal areas at a depth of 2000 to 4000 feet, and has at least this merit—that, so far as it is accurately reproduced, it distinguishes those areas, small as the scale is, more clearly than in the original. But in Hull's book one has the text as a commentary on the map, and from this we learn how problematical some of those areas are. For example, a coalfield is shown running along the coast of Northumberland from the immediate vicinity of Berwick to a point south of Holy island. That is originally entered on the map on the basis of the report by Sir L. Wood, given in Part VI. of the Final Report of the recent Royal Commission on Coal Supplies; but Hull, who is generally sufficiently sanguine as to the extent of our coal supplies, expressly states in his text (p. 209 n.) that he excludes this area from his estimate of our available coal resources, as it is inconceivable to him that the thin and intermittent seams of the carboniferous limestone area in which they occur could ever become available at such necessarily great depths, even if all the upper seams of the true coal-measures were worked out.

In the French work of Fallex and Mairey, this coalfield map appears in a still more unsatisfactory form on p. 133, no distinction being made at all between known and conjectured coalfields, and the town of Berwick is actually made to appear surrounded by one of "the principal coal basins of Great Britain." This last work is on a much smaller scale than either of the two German works noticed, having not only a smaller number of pages, but a page of a much smaller size. It certainly has good points, among which may be mentioned its clearness of exposition and description, its apt quotations, and some of its sketch-maps, diagrams, and other illustrations. It has, however, a rather regrettable number of errors, many indeed trifling, but others more serious. Its account of the European climate and the conditions on which it depends is in one or two points fundamentally faulty. To say that English sheep furnish only a small quantity of the wool required by the woollen industry of the "West Reading" of Yorkshire (p. 137) never was true. Certainly the great part of the raw material comes, as stated, from Australia, but it is only quite recently that South America, which is also given as a principal source of supply, has come to furnish us with any considerable quantity, and it has never supplied us with as much as our own sheep, or even as much as South Africa, which is not mentioned. To single out shawls as the sole speciality of the Glasgow textile industry is absurd. It is out of date to mention cutlery as the staple industry of Sheffield (p. 122); also out of date to speak of Germany (p. 442) as coming after the United Kingdom in the production of iron. One reads nowhere else of the "ancient abbeys of Balmoral and Abbotsford" (p. 123). A further enumeration, however, might be misleading, as for the most part the compilation appears to be carefully done. G. G. C.

The Ancient Geography of Europe.

'European Animals: their Geological History and Geographical Distribution.' London: Archibald Constable & Co., Ltd. 1907. Pp. xiv + 258. *Illustrated. Price 7s. 6d. net.*

For his great industry in bringing together such a large number of facts connected with the past and present distribution of the animals of Europe, together

with much valuable geological information, the author of this work (which is based on a course of lectures recently delivered at South Kensington) has earned the thanks of students of both zoology and historical geography. Such an amount of information it would, indeed, be difficult to obtain from any other source.

These facts are, however, but the foundation-stones upon which Dr. Scharff has built a large superstructure in connection with the past distribution of sea and land. All who are acquainted with his previous works will scarcely require to be told that the author has no hide-bound prejudices in regard to the permanency of continents. On the contrary, we venture to think that he is too prone to invocate continental connections when the facts might be much better explained without their aid. Indeed, he appears to us to introduce such connections when they are absolutely contrary to biological evidence.

To confine ourselves to a single instance, we may take the chapter devoted to Scandinavia, in which the author endeavours to prove that the Arctic animals of western Norway, such as the reindeer, effected an entrance into the country by way of a land-connection with Greenland.

That there was a former land-bridge after the first great (Scandinavian) glaciation connecting northern Scotland with western Norway north of lat. 59° may be freely admitted, and likewise that this was the route by which the animals in question reached the latter country. This, however, is a very different matter from a connection with Greenland, in regard to which two well-known American writers recently expressed their astonishment at the meagre details upon which such sweeping generalizations were based, more especially as the so-called facts are far from certain.

The hypothesis renders it, of course, necessary to assume that reindeer were originally American animals; but, as Mr. Madison Grant has observed in his excellent paper on the "Origin and Relationship of the Large Mammals of North America" (1904), there is every reason to believe that the entire deer family originated in the northern continent of the Old World, whence a small contingent entered the New World by a land bridge across Bering strait. Since, so far as we are aware, there is not a single fact which militates against this belief, the theory of an immigration of the reindeer from Greenland into Scotland and Norway, and consequently of a dual origin for the animals of Western Europe, is shattered. Indeed, unless the belief in the Old-World origin of the deer tribe can be proved false, it is in the highest degree improbable that there has ever been any late land-connection between the eastern and western hemispheres except across Bering strait.

In place of the reindeer coming from Greenland, there is, as Dr. Stejneger (*Smithson. Miscell. Coll.*, vol. 48, pp. 503 and 513 (1907)) has remarked, good reason to believe that the so-called Atlantic fauna of Scotland and western Norway was derived from Central Europe, entering Scotland towards the close of the great glaciation, and thence reaching Ireland first and afterwards Norway.

As criticisms of a somewhat similar nature might be urged against several of the author's theories, it is evident that while the book is a valuable storehouse of facts connected with the distribution of European animals, yet it can scarcely be accepted as a trustworthy guide to the form of the European continent in prehistoric times. Perhaps one of its greatest faults is the confidence with which these ill-supported generalizations are given to the world. R. L.

CAPRI.

'The Book of Capri.' By Harold E. Trower. *Illustrated.* Pp. xxviii. and 345. Naples: Emil Prass. 1906.

This is a very full and eminently readable *Guide raisonné* to Capri, written for the most part by the British Consular agent, who has spent over ten years on the

island. He has had the help of Mr. Silva White in the chapter on climate, of Dr. I. Cerio in that on geology, and of Mrs. Longworth Knocker in that on flowers. Other contributions also are acknowledged in the concluding chapters, which are in the nature of appendices relating romantic incidents connected with the place. The author gives a bibliography, and has evidently taken great pains to include both in that and in his text all kinds of recent information and research. The book will add greatly to the interest and pleasure of any one visiting Capri, and especially of any one who makes a protracted stay; and it is not the less suited to its purpose for being written in a popular style, and including a good deal of matter not to be expected in an ordinary guide-book.

ASIA.

Formosa.

'Japanese Rule in Formosa.' By Yosaburo Takekoshi; with Preface by Baron Shimpei Goto, Chief of the Civil Administration. Translated by George Braithwaite. 8vo. *With 38 Illustrations and a Map.* Pp. 342. London: Longmans, Green, & Co. 1907. *Price* 10*s*. 6*d*. *net.*

Baron Goto, in introducing the author of this volume to his readers, complains that, while the Japanese administration of Formosa has been severely criticized, the majority of the critics have never visited the island, and are singularly ignorant of the conditions now obtaining. And if this be true of his fellow-countrymen, it must be admitted that we in England have, if anything, still less knowledge of the island than they, for previous to the Japanese occupation few persons besides naval officers and wandering naturalists had set foot upon its shores. The present volume may therefore be said to be especially useful, for even now books treating of Formosa are exceedingly limited in number, and not many of their authors have had such opportunities as Mr. Takekoshi, who, in addition to making extensive journeys about the country, has had access to most sources of official information in his capacity of member of the Japanese Diet.

The book bears evidence of being rather hastily put together, and contains some rather bizarre English, but it is not lacking in information. Mr. Takekoshi is evidently chiefly interested in administration and politics, and hence we have special chapters on finance and economics, the relation of landlord and tenant, police administration, education, the courts of justice, and the question of the three monopolies—salt, opium, and camphor—as well as some sixty pages on the past history of the island, but matters geographical are by no means unrepresented. It is true that, when speaking of the fauna and flora and geographical distribution, the author is far from being at home, and seems to be ignorant of the work of Swinhoe, Adams, and other naturalists—or perhaps we ought to say to know them only by repute, for they are mentioned in the bibliography; but his chapters on the development of the island's resources, on the Formosan savages, on tea and other leading products, and on communications, trade, and harbours, are nevertheless full of information. Mr. Takekoshi has a strong admiration for the British and their methods of rule, and he would like to see the less-known parts of the island put in the hands of one or more chartered companies for some twenty years or so.

It cannot be laid to the charge of the Japanese that they have not troubled to make themselves acquainted with the land and the people that have come into their possession. The whole area of Formosa has now been accurately surveyed and its productive capacity ascertained, and there is no field or plantation, however small, which will not be found upon the map. Eight hundred officials, conducting inquiries into customs, ownership, etc., worked side by side with many corps of engineers

until the survey was completed. The number of savages—who, it may be mentioned, occupy nearly half the island, and that, it is believed, much the richest in timber, gold, iron, and oil—is placed at 104,000. The two specialists, Messrs. Ino and Kurino, who were detailed by Government to report on these people, divide them into eight groups, each having its own peculiar language and customs. These are the Atayal, Vonum, Tsou, Tsalisen, Paiwan, Puyuma, Ami, and Pepohoan. Of these, in addition to various details of their distinguishing characteristics, etc., Mr. Takekoshi gives type photographs, but they cannot be said to be entirely satisfactory, for two of them—the Atayal man and the Paiwan woman—have certainly a very large admixture of Chinese blood. Some interesting statistics are given of the climate, rainfall, etc., and also of the camphor industry. There is, unfortunately, no index, but the omission is partly atoned for by a tolerably full and careful bibliography, albeit somewhat unnecessarily full of misprints and errors. That the author has not himself consulted all the works mentioned is probable. One of them is given as "'Formosa' by the author of 'Anonyma.'" We are unacquainted with the book in question, but without undue rashness we may hazard the surmise that it deals with another world than that of which Mr. Takekoshi writes.

F. H. H. G.

AFRICA.

The Egyptian Sudan.

'The Egyptian Sudan: its History and Monuments.' By E. A. Wallis Budge. 2 vols. *Illustrated*. Pp. xxviii., 652; x., 618. London: Kegan Paul & Co. 1907.

We do not pretend adequately to review this large and important work here. As its sub-title implies, the staple of its matter and the ground of its merit lie outside the field of geography. What comes within the purview of this *Journal* is of less importance than the rest, and not so largely based on first-hand observation and research. We find a useful chapter of travel-bibliography at the outset, the result of considerable labour, and in the long catalogue note but one slip. "The eminent traveller Niebuhr (born March 17, 1733, died 1763) who visited Egypt in 1761" is Carsten of that ilk; but he lived to be about fourscore years of age. The date 1763 is that of his return to his native land from Yemen, not the date of his death. Further, there is a summary survey of all the Sudanese provinces and their inhabitants, with certain remarks on racial types and social customs. In the northern riverain Sudan this is enriched by the author's own observation. The rest is taken in the main from recent official works, such as Count Gleichen's 'Handbook' and Sir W. Garstin's Nile Bluebook, and is not intended for geographers, but for those to whom the original sources are inaccessible or distasteful. Lastly, there are scattered up and down the two volumes many notes and impressions of the aspect of the northern Sudan just after the close of the Mahdist period. These have a historical value which is enhanced by the privileged position and undoubted competence of the observer. Dr. Budge's knowledge of Arabic and long familiarity with Nilotic scenes and peoples gave him a great advantage over the special correspondents and the like who have hitherto been our chief authorities for the appearance of the Sudan during and immediately after Kitchener's advance. It should be added that pretty nearly all that is known concerning the ancient geography and topography of the Nilotic Sudan is to be found somewhere or other in the book; but so far as we have been able to discover, no new local identification is adduced, and Dr. Budge confines himself in this connection to the river valley. The great body of the book is outside our scope. It deals very fully with the ancient history of the Sudan, and more summarily with the modern.

There is a very careful description of all the extant antiquities, both those now in the country and those that have been removed. And embedded among these scientific chapters is the material for an excellent travel-book. We venture to think this matter would have been better used apart. It appeals to different readers and to an incongruous mental phase. Its intermixture with the scientific chapters will rob it of all but a small proportion of its due audience; and the scientific matter also suffers in its turn. The public is doubtless wrong, but nothing cures it of a vague distrust of the scientific between the same covers as the popular. It cannot bear uncertainty as to how it stands with an author, and is suspicious of literary versatility. Dr. Budge's 'Travels and Discoveries' would have been one of the successes of the season. Dr. Budge's 'History of Nubia and the Sudan' would have found many hundreds of serious readers and remained an indispensable book of reference. Dr. Budge's 'Compendium,' embracing the matter of both those books, will not reach a tithe of their potential public.

Races of Nyasaland.

'The Native Races of the British Empire: British Central Africa.' By A. Werner. London: Constable. 1906. Pp. xii., 303. Size 9 × 5½. *Price* 6*s*.

This book more than upholds the promise of the other volumes of the series. Miss Werner has the advantage of an intimate acquaintance with the natives of whom she writes, having lived amongst them for some years. Consequently she can treat of them with a real sympathy, and her book lives in a way which those written by the man at home, however well he may know his subject, can never do.

The natives treated of by Miss Werner are those living on the Shiré and around the west of Lake Nyasa, as well as some dwelling in what is politically North-Eastern Rhodesia. The book follows the plan laid down for the series, there being chapters on Magic and Religion, on Native Life and Industry, and on the inhabitants generally. Probably the most valuable chapter is that on Language, as Miss Werner has made a life-study of African tongues, but it is rather difficult to understand why musical instruments should have been included under this heading. In the chapter on Folk Stories Miss Werner points to the connection between these African stories and the Uncle Remus tales, a connection now generally accepted, while in that on Traditions and History, there is a useful account of the migrations of the tribes. The book has the advantage of a glossary of native words and of a map, which, however, might have been larger. The book is well illustrated, but in a few cases more care might have been taken in the arrangement of the photographs on the plates.

POLAR REGIONS.

Peary's 'Nearest the Pole.'

'Nearest the Pole.' By R. E. Peary, U.S.N. *With 98 illustrations and 2 maps*. London: Hutchinson & Co. 1907.

Commander Robert E. Peary ranks among the greatest Arctic explorers: as a traveller with dogs and Eskimo he is superior to all others. Let those who have not followed his footsteps during the past fifteen years turn to the map which accompanies this volume. From the 77th to the 87th parallel of latitude, 600 geographical miles of frozen land and water, and across 70° of longitude, Peary's tracks show on the chart like the meshes of a spider's web. Over the inland ice of Greenland to the northern extension of that island continent, across Ellesmere

Land, Grinnell Land, Grant Land, and his last and greatest effort across the polar ice to within 174 miles of the northern apex of our Earth!

Be it remembered that during the twenty years Peary has been exploring the Far North, he has received no financial support from his national treasury. The funds supporting his earlier expeditions were derived from his limited resources, the aid of a few friends, and grants from some of the scientific societies of the United States. Later, a few ardent admirers founded the Peary Arctic Club to further polar exploration under their distinguished countryman. It was with the aid of this society that Peary undertook his expedition of 1905–6. In 1904 the Peary Club decided to build a ship suited for Arctic exploration. All that scientific American ship-building could devise is claimed to be embodied in the *Roosevelt*, and Peary expresses his conviction that she has been proved the best ship ever built for Arctic work.

The *Roosevelt* left New York on July 16, 1905. The crew numbered twenty, six being citizens of the United States; the remainder, including sailing-master and mate, natives of Newfoundland. After a favourable voyage through Davis strait, Baffin bay, and Melville bay, the *Roosevelt* on August 7 arrived off Cape York. Landing there, Peary is once more amongst those he styles "my Eskimo," "my faithful people." These, the most northern dwellers on the Earth, are a small clan, probably never exceeding an aggregate of 400 individuals, living along the west coast of Northern Greenland. Fenced in between the ice of Melville bay and the great glaciers to the north and the inland ice, this small community, probably for ages, had been cut off from intercourse with the rest of mankind. Discovered in 1818 by Captain Sir John Ross, they were subsequently brought to notice by Kane, Hayes, and Bessels, who in different years wintered in their territory, and who have given many accounts of their natural good qualities and their superlative attainments as dog-sledge drivers and hunters in their frozen world. It is to Peary, however, we owe the most remarkable conjunction of effort between the scientist and the savage that the records of Arctic exploration afford. The white man, saturated with the one ideal—exploration of the polar regions, planned to make these Eskimo his allies. He lived amongst them summer and winter, he became their friend. His wife joined him, and their daughter was born in their midst. Great must be Peary's magnetic influence over these children of Nature. They follow him with all the faithfulness of their own dogs, those invaluable animals which have been the bed-rock of Peary's triumphs. They pass with him without question into remote lands; he tells them to go forth into the "Great Night" and bring back food, and they do so; they follow him over the polar pack, rendering service impossible from white men. Herein Peary has full reward; he gathered to his fold these children of the snow, and by their aid wrings tribute from the "Ice King."

No time was lost in collecting the Eskimo deemed necessary for the campaign. At midnight of August 16 the *Roosevelt*, with an addition of over fifty natives—men, women, and children—with their belongings, and 200 dogs, swung out of the harbour of Etah, and now commenced the struggle for which she was built. The fierce battles with the heavy polar ice of Smith sound continued for twenty days, but on September 5 the *Roosevelt* rounded Cape Union and lay along the northern shore of Grant Land at Cape Sheridan, some 2 miles beyond the winter quarters of the *Alert* in 1875–76. Peary claims to have distanced his predecessors—a small matter—but had he consulted the narrative of Sir George Nares, he would have found that that able navigator pushed the bluff-bowed *Alert* to Cape Sheridan, but, considering that position too exposed, fell back to "Hoeberg Beach." Cape Sheridan proved an unsatisfactory winter quarter. The coast-line there is exposed to the full force

of the polar pack pressing on shore, but Peary had come to the limit of navigation for the season, and he determined to cling to the highest point reached. His ship passed through many and great dangers during the autumn and winter, but came through her trials uninjured, as did the *Alert* thirty years before. Peary at once sent his Eskimo hunting; they dispersed over this land of desolation from Cape Joseph Henry to as far south as the Lake Hagen district. From that time until February of the next year, the dogs and the greater part of the natives remained away from the ship, only returning with meat during the periods of full moon. Some 2(0 musk-oxen and reindeer were secured, probably as many hares, and salmon-trout from Lake Hagen. Thus Peary, with the help of his Eskimo, was abundantly supplied with fresh food. Under similar conditions white men are restricted to a narrow circuit around their winter quarters. Unfortunately, great mortality occurred amongst the dogs.

On February 19, 1906, the first sledge-party left the *Roosevelt* for Cape Hecla. Three days later the entire party for the attack on the pole was there assembled: six white men, Henson, and twenty-one Eskimo with 120 dogs—the personnel for one main and five or six supporting parties. By March 6 Peary had started all his auxiliary sledges on the ice, and on that date he himself headed northward from the land over the polar pack. The usual obstacles were encountered and overcome, but in lat. 84° 38′ Peary was brought up by a broad lead of open water, extending for miles east and west, which he thinks is a more or less permanent crack between the land-ice of Lincoln sea and the polar pack. From there Peary sent back his auxiliary sledges for supplies; but seven precious days were lost, and it was not till April 2 that he and Henson were able to cross this great lead, though the temperature registered from $-60°$ to $-66°$ Fahr. Pressing north with Henson, every conceivable difficulty of ice-travel was encountered; but Peary remarked, "My little brown children of the ice tooled their sledges through it with the skill born of life-long experience." On April 4 terribly stormy weather came on, which obliged the party to build igloos, and shelter themselves within. No men could travel in such a storm; it was a physical impossibility even for Eskimo. Six days was Peary detained in Storm camp. The gale moderating, these determined men still pushed northward—eight in all. The conditions of the ice became better for travelling. The worn-out dogs were killed, and fed to the others. During the last days of the advance, Peary by desperate effort was making rushes of between 20 and 30 miles a day. On April 21 the latitude of 87° 6′ was reached, and Peary knew he had shot his last bolt, and that he must endeavour to retrace his steps. Forty-seven days had Peary been on the polar ice, for twelve detained by open water and unprecedented weather. Eliminate these unlooked-for causes of detention, and there can be little doubt Peary would have reached the North Pole. It was a great attempt, and fought to the very limit of human endurance. The sufferings and trials of the return were as great, if not greater, than those encountered in the advance. The fierce storms and shifting of the ice had obliterated the trail. It was Peary's hope that his supports might have brought forward and left supplies at Storm camp. In this he was disappointed. From there he set a "bee-line" course for the Greenland coast. He alone of the party knew how far the eastward drift of the pack had taken them, and that salvation lay in Greenland and its musk-oxen. To their horror, after a few marches they again found the great lead of open water some 2 miles in width. Delayed at its brink, each day the number of the dogs dwindled, and sledges were broken to cook the animals they ate. At last a film of young ice formed over the lead, and they crossed on their snow-shoes as if by a miracle. After great vicissitudes, they crawled on to the northern coast of Greenland at Cape Neumayer. With astonishing good fortune, just before landing they crossed a fresh sledge-trail;

it proved to be that of Clark and his three Eskimo; one of the supporting parties drifted likewise to the eastward. Peary finds them perishing, but saves them. It was weary travel for these starving men along the north shores of Greenland. Fortunately a small herd of musk-oxen were met with, and all secured. This probably saved the lives of the entire party. At last Robeson channel was crossed and the *Roosevelt* regained. Unfortunately, Peary gives no dates in his narrative after his turning back on April 21, but the return appears to have been in the last week of May. After resting a week on board, the indefatigable traveller again set forth, with thirty-nine dogs, the residue of one hundred and twenty with which he commenced spring operations. On June 8 Peary is at Cape Columbia. There on its summit he builds a cairn, displays the Stars and Stripes, and leaves a record with a piece of the flag. This is very proper; but Peary might have reminded us that, thirty years before, Aldrich unfurled the Union Jack on this the most northern point of the American continent, and that Nares gave it the name it bears. In 1876 it took Aldrich twenty-three days with man-hauled sledge to reach Cape Columbia from Cape Sheridan. Peary, with dogs and Eskimo, covered the same distance in six. Nothing can ever belittle the stupendous work of British sailors dragging their sledges for thousands of miles of Arctic travel; their bravery, their constancy, their hardy virtues, remain a national heritage for all time, but the old order changeth.

Now the short summer episode is reaching its zenith, and the lately frozen earth turns into knee-deep mud, the snow is slush to the hips, the floes are covered with deep pools of water, and crawling icy-cold streams are the pervading surroundings. The difficulties of summer sledging are little less than those encountered in the polar spring. Through all this Peary plods his way; he passes Aldrich's "farthest," and joins hands with Sverdrup to the south, completing the circuit of the coast of Grant Land. Crossing Nansen sound, he lands on Axel Heiberg Land, and from it makes the chief discovery of the expedition. Far to the north-west he descries new land, lying approximately in 83rd degree of latitude—an interesting discovery, proving that the continental shelf fringes the polar basin greatly to the westward of Grant Land, and giving indications that there are still realms to conquer in the unknown area of the Beaufort sea. Peary's return journey to the ship, over decomposing land, ice, and snow, was very trying. The *Roosevelt* broke out of her winter quarters on July 4, and after a long and perilous voyage of five months, during which she was sadly mauled by the Smith sound ice, reached New York harbour on Christmas Eve, 1896, without a single casualty amongst the members of the expedition. Peary thus sums up the results obtained: Attainment of the "highest north;" Determination of new land north-west of Grant Land; the widening of our horizon as regards ice-conditions in the western half of the polar sea; the connecting of the unknown coast between Aldrich's farthest west in 1876 and Sverdrup's farthest north in 1902; the determination of the unique glacial fringe and floeberg nursery of the Grant Land coast. It is regrettable that Peary did not, or could not, carry a sounding apparatus on his northern journey; a reliable sounding in the 87th degree would have been of incalculable value, and a fitting adjunct to a great adventure.

H. W. F.

THE MONTHLY RECORD.

EUROPE.

Alpine Plants on Scottish Mountains.—It is still a doubtful question how far the occurrence of plants of restricted distribution, such as those of mountain summits, is determined by the chemical constituents of the rocks on which they grow, some holding that there is an intimate connection between the plants and rock-constituents, while others lay greater stress on other conditions, such as exposure, water-supply, etc. The latter view is adopted by Mr. Peter Ewing in an address to the Natural History Society of Glasgow lately printed (*Transactions*, vol. 7 (N.S.), part 3). He bases his conclusions on the alpine and arctic plants found on the summits of Ben Lawers and other Scotch mountains, and though his line of argument is not so clear as might be wished, the close acquaintance which he shows with the distribution of the plants in question gives some weight to his opinion. The district in question is traversed by a belt of what are known as phylite schists, and it is on these that many of the rarer alpine plants are found. But no definite law of distribution can be laid down. On comparing the mountains at the extreme ends of the schistose belt—Ben Lawers and Beinn Laoigh—it is found that the species are by no means identical. The latter mountain is partly formed of mica-schists, which are in places particularly rich in alpine plants owing to abundant moisture and shelter, while some parts of the phylites are barren owing to lack of moisture. A typical arctic plant—*Arabis petræa*—is found all over the mountain, whatever the rock-outcrop may be. Many instances are given of erratic distribution. Thus *A. alpina* is found only on basalt in Skye, though in other districts it occurs on granite, gneiss, syenite, and trap. Even if plants appear to grow better on some rock-formations than on others, this may—the writer thinks—be due to many other causes than chemical composition, *e.g.* the occurrence of pockets which provide good foothold, the power of holding water, the method of decomposition of the rocks, and so forth. The question is well worthy of further investigation.

The Lakes of the Berlin District.—An interesting study of the physical features of the district immediately west of Berlin, and particularly of its intricate system of small lakes, is contributed by Prof. F. Wahnschaffe to the *Naturwissens. Wochenschrift* for May 26, 1907. As is well known, the present features are mainly the result of the action of the great ice-sheet of the glacial epoch, which had its southern front about this latitude, and has left copious traces of its presence in its ground moraines and the deposits (mostly sands) laid down by the waters derived from its melting. The great streams of this period have left their mark in the great valleys, such as that in which Berlin is placed, which runs west-north-west, and can be traced from the Oder to the Elbe. They are bounded by stretches of higher ground, largely composed of drift, with a slightly undulating surface broken here and there by hollows, which either occur singly or lie in rows in narrow furrows. The existing streams only utilize in part the beds of the old river-courses. Thus the system of the Havel, in Prof. Wahnschaffe's opinion, is a much younger formation than the Berlin valley, as the connecting portion of its course between the Eberswald and Berlin valleys bears a much more recent character than the portion further south, where, to the south-west of Berlin, it passes through a succession of narrow lakes occupying a furrow in the diluvial plateau, and showing remarkable variations of depth, the deeper places being probably the remnants of larger expanses of deep water which have been in great part filled by sediment. The sandy tract of the Grunewald separates the lakes of the Havel from a smaller

series to the eas', known as the Grunewaldseen. It is evident that neither of the chains of lakes can have been hollowed out by the existing watercourses, but that the hollows which they fill date from the time of the last ice-sheet, the irregularities in their beds being probably due to the work of water flowing under the ice. Since that time parts of the depressions have been filled up by the formation of peat, and the last part of the paper is devoted to a consideration of the different types of moor represented, the district affording unusual opportunities for studying the whole process of moor-formation through all its stages.

Anthropogeography of Lower Austria.—Dr. O. Firbas has written a comprehensive monograph (*Forschungen zur deutschen Landes u. Volkskunde*, vol. 16, No. 5), illustrated by eight maps and twenty-three cuts, in elucidation of one "viertel" of Lower Austria—that known as "Under-the-Manhartsberg." Viewing the present population as the resultant of all the forces that have gone to the making of it, the author, taking but subordinate account of historic traditions, has directed his attention the more to the present conditions of the domain as compared with those of neighbouring lands, so as to arrive, geographically, at a determination of the genesis of its population. "Under-the-Manhartsberg" is bounded north and east by the frontier line, on the south by the Danube, on the west by the steep slope of the Manhart mountains, where the boundary-line follows the contour of 1000 feet. The "viertel" has an area of 1794 square miles and a population of 377,972. The detailed geology of Weinlandl—still mostly virgin-ground—the author reserves for a future task. Yet the monograph brings out in broad characters the determining influence of the geology on the anthropology of the region. The other physical factors taken into account include genetic morphology, climate and vegetation, while on the anthropological side the author investigates the bodily characteristics of the population, its intellectual products—more particularly language—the local nomenclature, house-building, and settlements, and inquires how far these elements are an indication of anthropological types. Of highly popular, as well as scientific, interest is the chapter on types. A broad strip along the south bank of the Danube, stretching from Bavaria eastwards, is the most faintly streaked by the blond type. Scheibbs and Lilienfeld districts, *e.g.*, have but 17 per cent. blond. South-east of this is a blond island from Baden *viâ* Neunkirchen to Bruck. North of it, too, is a rather blond strip running parallel to the Danube; and to the north of this, again, south of the Thaya, we find the greatest proportion of blondness. As a rule followed with the uniformity of a law of nature, the writer postulates that in Central Europe the people of pure protomorphic type always constitute together about 40 per cent. against 60 per cent. of mixed metamorphic type, and this rule applies to the whole territory between the Baltic and the Adriatic, where white and brown struggle with one another for the mastery. In Lower Austria, *e.g.*, the sum of the two pure types makes 43·9 per cent. This phenomenon is accounted for by the fact that the longer two types dwell together in one habitat the more will they become mixed, whereas the shorter the period of their cohabitation the more will the protomorphic types prevail. The proportion of protomorphic to mixed type in one locality may accordingly be taken as a fair indication of how long the mixed type has been in process of formation.

ASIA.

Dr. Longstaff's Ascent of Trisul.—A few further particulars respecting Dr. Longstaff's ascent of this peak (*cf.* August number, p. 211) reached this country towards the end of July. It appears that a base camp was established at the mouth of the Trisul nullah, at about 11,100 feet, the party afterwards moving to a higher

camp at about 16,750 feet. The travelling had for some days been very rough, and the weather inclement. On June 12, Dr. Longstaff started for the summit, accompanied by the Brocherels and by Jemadar Kabir Burathoki, of the 5th Gurkha Rifles. By noon a height of 20,500 feet was reached, the going being steep but easy on about 6 inches of snow. The slopes continued steep but easy up to the summit, which was reached at 4 p.m. in the teeth of a bitterly cold wind. The party regained their tent soon after 7 p.m., and returned to the base camp on June 13.

New Expedition to the Tian Shan.—We learn from the *Geographische Zeitschrift* that Prince Arnulf of Bavaria, third son of the Prince Regent Luitpold, set out for the Tian Shan in April last, accompanied by Dr. Merzbacher, the geologist Dr. Leuchs, and one or two other Europeans. The prince's object is mainly sport, but Dr. Merzbacher hopes to continue his well-known scientific investigations into the morphology and other features of the range. The final organization of the expedition was to take place at Kulja, and the travellers expected to be home before the end of the year.

AFRICA.

The Increase of the Water-supply of Egypt.—A despatch from Lord Cromer, written shortly before his retirement, and since printed as a parliamentary paper (Cd. 3397, Egypt, No. 2, 1907), sums up the results of the studies by Sir W. Garstin, Sir B. Baker, and others, which have led to the decision to increase the water-supply of Egypt by raising the height of the Assuan dam 7 metres, or some 23 feet. It is pointed out that an enormous benefit is now known to have been conferred on Egypt by the existing dam, the sale value of the lands already irrigated through its means having increased by over £24,000,000. But the reservoir supplies only about a quarter of the water needed by the country, so that there can be no doubt as to the advisability of an increase. This could be brought about either by further storage in reservoirs, or by preventing the waste in the Bahr-el-Gebel marshes, and the result of careful inquiry has been to show that, if the whole of the needed supply is ever to be obtained, it will be necessary to make use of both methods. Before deciding on the best means of adding to the storage capacity, a careful examination of those reaches of the river between Wadi Halfa and Khartum was made by survey parties acting under the direction of Captain Lyons. Only three such reaches seemed to fulfil the necessary conditions, viz. those from Khartum to Hagar-el-Asl, from Berber to Shirri island, and from Abu Fatma to Wadi Halfa. The result of the surveys was to produce excellent detailed maps of these three reaches, the rocks being also carefully examined, but they have also shown that no site exists which can be recommended for the construction of a new reservoir. The raising of the Assuan dam was thus the only course left open, and though this involved the submersion, during a portion of the year, of the temples at Philæ, it was felt that it would be unjustifiable to save these by sacrificing the present and future interests of the people of Egypt. All possible steps will, however, be taken to minimize the possible injury to archæological interests, and the following measures are laid down as necessary for this end: (1) The conservation of such structures as may be wholly or partially submerged, by the consolidation of their foundations; (2) Repair and reconstruction of the upper portions of these where such is advisable; (3) the systematic study of the ancient structures, sites, settlements, cemeteries, etc. The question of the raising of the dam has been exhaustively studied by Sir Benjamin Baker from an engineering point of view, with the result that all difficulties were at last met, and the storage of nearly two and a half times the present quantity of water proved perfectly feasible and safe.

Port Sudan and its Trade.—A Consular Report (Annual Series, No. 3755) records the progress made in the transformation of Port Sudan, and in the development of its trade. Lying 35 miles north of Suakin, it is protected from heavy seas by reefs, and, as a port of entry and forwarding station, has superseded Suakin. Besides its sea communications, it is in railway communication with the Atbara, Khartum, Wady Halfa, etc. The inlet, which is 500 yards wide for the first mile, then expands, on the south side, into a basin 900 by 500 yards, with a minimum depth of 6 fathoms. The channel continues 2 miles further up, with a basin on the north side and one at the end. The inlet has a minimum depth the whole way up of 2¾ fathoms, and its narrowest part is over 70 yards wide. On the north side are the railway terminus and custom house, and quays in process of construction. When completed, the quay will be 1¼ mile long, accommodating twelve to fourteen ships, and before long the port will be as well equipped as Alexandria. A bridge, available for every kind of traffic, is to unite the two parts of the port, and will open to give access to the upper waters, where a dock has been begun. The port will become an outlet, not only for the Sudan, but also for the greater part of Abyssinia and the Congo State. The returns already show a notable increase in the trade of the port.

Surveys in Somaliland.—A note in the lately issued report of the Board of Scientific Advice for India (1905–06) deals with recent explorations in Somaliland. In 1903 Captain Beazeley, R.E., of the Indian Survey, accompanied the Somaliland expedition, and succeeded in surveying 15,000 square miles on the 4 miles to 1 inch scale. He describes the region as one vast bed of limestone several thousand feet in thickness. The surface rises at a uniform slope of 10 feet a mile from the south-east coast-line, and attains an elevation of 3000 feet where it abuts against the mountains of Abyssinia. Somaliland is thus a tilted plateau. The drainage of the south-eastern mountains of Abyssinia is across Somaliland, but all these streams disappear before they reach the sea. The Webbe Shebeli, for instance, has a considerable volume of water derived from the Abyssinian snows, and it maintains its course in Somaliland for upwards of 700 miles, but it loses itself in sandy soil 20 miles before reaching the coast. There is a curious and well-marked underground system of drainage which supplies wells all over the country. An impermeable stratum appears to exist 60 or 70 feet below the ground surface, and when wells are deepened below this their water disappears. The Der river has a distinct bed for 150 miles, but it then vanishes in marshy ground; after remaining hidden for 100 miles it reappears at the surface and flows to the sea under the name of the Dun. The present inhabitants of Somaliland are nomads, who expelled the Gallas, the former inhabitants. The latter irrigated and cultivated the land, but all traces of their civilization are dying out, for the nomads make no attempt to cultivate, and to this the decadence of the country and the diminished rainfall are ascribed.

Earth-movements in South Africa.—Prof. E. H. Schwarz, whose contributions to the physical history of South Africa have frequently been referred to in the *Journal*, has lately called attention to the rock channel of the Buffalo river at East London as supplying evidence of an undoubted submergence of the land, in a region which has been equally certainly subject to general emergence, as witnessed by beach-covered flats at elevations of 200 to 400 feet above sea-level (*Records of the Albany Museum*, vol. 2, No. 1). The data proving the existence of this rock-channel (which are embodied by Prof. Schwarz in a diagram) have been obtained from borings made under the direction of Mr. J. J. Godfrey for the purpose of testing the foundations of a railway bridge. They show that the channel was cut in rock consisting apparently of shales and sandstones of the Beaufort series, and after

being submerged about 122 feet, has been filled in with sand and mud. In three bore-holes gas was struck, which in two cases escaped with explosive violence. It is doubtless due to the decomposition of organic matter contained in the clay.

Ethnological Research in the Interior of South Africa.—The well-known traveller, Dr. Rudolf Pöch, has been commissioned by the Imperial Academy of Sciences in Vienna to make anthropological and ethnological investigations amongst the Bushmen of South Africa, for which country he is to start in October. His stay among the Bushmen will probably last for one and a half to two years. Pöch will follow up the investigations of Fritsch, Burchell, Campbell, Moffat, T. Hahn, W. H. J. Bleek, and S. Passarge, being guided, however, in his procedure by the expeditions of Prof. Alfred C. Haddon (Cambridge) to the Torres Strait islanders and of Prof. Baldwin Spencer (Melbourne) to the natives of Central Australia. He will be the first trained observer to work on the spot among the free Bushmen. As he did among the Papuans of New Guinea, he will here too, among other things, take phonographic and cinematographic sketches of life and manners. The main problem, however, calling for solution is the precise determination of the relations of the Bushmen to the Hottentots. These two constitute a group of people distinguished as Koikoin, a group standing in contrast to that of the Bantu. The field of his activity will be the Chanse Veld, the seat of the tribes of Bushmen that have kept themselves, down to the present time, pure and unmixed, the tribes of the Aukwe and Kung. The Chanse Veld lies in British Bechuanaland, south-west of Lake Ngami, towards the frontier of German South-West Africa. It is known as one of the most extensive fertile tracts, with constant water-supply, on the edge of the Kalahari desert. After the railway journey from Swakopmund to Windhoek, the route runs by way of Gobabis and Rietfontein. Here is a "permit," a spot where it is allowed to cross the border. At this point Dr. Pöch will set foot on British territory, and in Kwachara^3 nei ("3" denoting one of the well-known clicking sounds), the westernmost place in the Chanse Veld, enter on his investigations. In the German colony he will have, as basis of comparison, the Nama and other Hottentot tribes. Having completed his tasks in the Chanse Veld, Dr. Pöch will possibly proceed further east to the Botletle and thence to Palapye and Mafeking.

French West Africa.—A Consular Report (Annual Series, No. 3763) supplies some information respecting the progress of French West Africa. It is now decided that the Trans-Saharan telegraph is to strike the Niger at Burrem. A new line, 1075 miles long, is to run from Timbuktu to Burrem, and thence to Niame and Zinder. Connected with the Trans-Saharan line, the new line will bring into the telegraphic system the region between Zinder and Lake Chad. Not less active is the progress of railway communication. A preliminary survey has been made of the Thies-Kayes railway. The Konakri-Niger railway is now opened to traffic for 138 miles, and the remaining 48½ miles are expected to be completed this year. From the terminus at Col de Kumi, 2333 feet high, a railway line will reach Kurussa probably in 1910. Opened last January to traffic as far as Eri Makionye (47½ miles), the Ivory Coast railway is constructed 4 miles farther to Aniebos river, over which a bridge is being built. In Dahome the permanent way was, in 1906, completed to Save, north of the Weme, the bridge over which is finished. The line may be opened to traffic this year. The Porto Novo—Sakete tramway, to open up the district between the Weme and the Lagos frontier, will be ready for traffic early in 1908. As regards agriculture, a reorganization of administration is contemplated with a view to uniformity of policy throughout French West Africa. A fishing station and a permanent lighthouse are to be set up at Cape Blanco, while the interests of agriculture and the fisheries are to be looked after by experts on the spot.

AMERICA.

The Recession of Niagara.—We alluded in the *Journal* for February last (p. 227) to Prof. J. W. Spencer's recent survey of Niagara, the preliminary results of which had been published in the summary report of the Geological Survey of Canada for 1905. We have since received the report by Dr. G. K. Gilbert on the rate of recession of the falls, as deduced from a survey made in 1905 by Mr. W. Carvel Hall, under the auspices of the United States Geological Survey and the State Engineer of New York, the results being compared with those of four previous surveys by official organizations in the United States. As in the Canadian report, the chief attention is devoted to the Canadian or Horseshoe falls, for the recession of the American falls (though considered in its turn) has little effect on the process of lengthening of the gorge. Many of the facts brought out are naturally identical with those recorded by Prof. Spencer, though as regards the conclusions reached, and the manner of arriving at them, some differences are noticeable. The two discussions are therefore useful as checks on each other. Dr. Gilbert wisely insists on the degree of uncertainty which must attach to any statements in the form of definite figures. A difficulty arises from the fact that in one place the recession seems to have been in one direction, at another in another direction, so that confusion arises if different parts are considered separately. He gets over this by assuming one general direction for the recession of the entire central portion of the horseshoe, and by measuring the amounts on lines parallel to this, an average being finally struck. An alternative method deals with the areas intercepted between the crest-lines at successive dates, but here again Dr. Gilbert starts from a line drawn across the river at right angles to what he assumes to be the general direction of recession. In either case he obtains an average annual rate of 5·3 feet for the whole period between 1842 (the year of the first official survey) and 1905. Dealing with the two shorter periods, 1842–1875 and 1875–1905, he finds that the rate was apparently considerably slower during the first than during the second, the figures differing, however, according to the method employed. A good deal evidently depends upon what is assumed to have been the general direction of recession, and the precision of the results must thereby be to some extent affected, especially in the comparative estimate for the two periods. Of late years the movement has been more and more concentrated along a line of weakness which has developed on the eastern or Goat island side of the crescent, and this fact has materially influenced the determination of the general direction for the whole period. For the interval 1842 to 1875 the easterly component was far less important, the greater part of the loss having been on the western side. Much of this loss is entirely left out of account in Dr. Gilbert's calculation, the result being to greatly lessen the rate obtained for the earlier period. Besides the surveys alluded to, Dr. Gilbert has made use of the sketches of both falls taken by Captain Basil Hall in 1827 (which he reproduces), pointing out that they derive some importance from having been made with the aid of the camera lucida. He has taken pains to correlate them with the map of the falls, and the result is to indicate that the central portion of the horseshoe was in 1827 almost exactly parallel with its position at the time of the survey of 1842, though the amount of recession in that interval comes out as less than was to be expected. A question is raised as to the general accuracy of the survey of 1842, which was incorrect, Dr. Gilbert finds, in one particular at least. But he thinks that greater weight must be given to the evidence of the survey than to that of the sketches. In any case, it is safe to assume that the annual rate of recession has been about 4 or 5 feet.

The Navigation of the La Plata.—The importance of improving the conditions of navigation on the La Plata estuary, the main gate of entrance from the outside world to the whole territory of the Argentine Republic, has long been realized. The route hitherto followed by ships of largest tonnage when entering the river is that on the eastern or Uruguay side of the great bank of La Playa Honda, by which the estuary is divided into two main channels. This route threads a somewhat intricate system of passes, with a depth in places of no more than 18 feet. For some time attention was directed to the improvement of this route by dredging and other works, but its disadvantages have of late been more and more realized, and schemes have been set on foot for opening a route on the Argentine side of the great bank. The present position of the question is discussed in an article by Señor A. Mercau in the *Anales de la Soc. Cientifica Argentina* for December, 1906 (vol. **62**, part 6). The writer gives details of the three most important propositions hitherto put forward for the improvement of navigation. The first is the deepening of the existing route, which is shown to present considerable difficulties, while the length of the route puts it at a decided disadvantage in comparison with the other projects. The second of these is one favoured by the authorities, and consists in the construction of a canal closely following the shore of the river on the Argentine side from La Plata to Buenos Aires, and thence to a point on the Parana de las Palmas, one of the southern branches of the Parana delta. The writer objects to this that it provides no access to the Uruguay. The third scheme is one which he put forward himself in 1900, and which provides for the deepening of the channels on the Argentine side, and their connection with the main mouth of the Parana by way of the Pozos del Barca Grande, side branches also supplying access to the Parana de las Palmas and other mouths. It is claimed for this that it would form the most direct route to the main mouth, and would also give easy access to the Uruguay. The advantage to the Argentine of keeping the main stream of traffic on the western side of the estuary is also emphasized. A plan accompanies the paper, and shows the lines followed by the several routes.

POLAR REGIONS.

The New British Antarctic Expedition.—There have been several changes in the programme of this expedition since Mr. Shackleton outlined his plans in the March number of the *Journal* (vol. **29**, p. 329). King Edward VII. Land has been selected in place of the winter quarters of the *Discovery* as the base of operations of the exploring party. A landing will, it is hoped, be effected by about the end of January of next year, in time to permit of the establishment of depôts to the south before the close of the Antarctic summer. The winter months are to be devoted to the pursuit of scientific investigations in the neighbourhood of the living-hut, and with the return of spring in the latter half of 1908, exploring parties will be sent out southwards in the direction of the pole, south-eastwards into the unknown region at the back of King Edward VII. Land, and east-north-east along the coast in the direction of Alexander I. Land and Graham Land. Nothing definite is known of the geographical conditions in any of these directions, and whether or not the polar contingent succeeds in covering the 700 or 800 geographical miles that will separate the winter quarters from the south pole, the combined explorations of the three parties may be expected to make interesting additions to knowledge of the distribution of land and sea in the Ross quadrant. Each party will comprise three members, while the remaining three of the dozen men who will be landed on King Edward VII. Land, including the biologist and the magnetician, will remain in charge of the hut. In addition to Mr. Shackleton, the landing party will include Mr. James Murray, a biologist who has done

excellent work in the survey of the Scottish lochs under Sir John Murray; Mr. Eric Marshall, the senior surgeon, who has been through a course of training in survey work under the Royal Geographical Society's instructor; Mr. A. F. Mackay, junior surgeon and zoologist; Lieut. Adams, R.N.R., who will be responsible for the meteorological observations; Sir Philip Brocklehurst, who has qualified to take part in the geological and survey work, and will be in charge of the Siberian ponies; and Ernest Joyce, lately first-class petty officer in the navy, who was a member of the *Discovery* expedition, and will have under his care the dogs and sledges. The best of everything has been obtained in the way of provisions and other supplies both for men and animals. Apart from the ponies and dogs, Mr. Shackleton will have for transport purposes a specially constructed motor-car, the value of which will be tested on the southward journey. A motor-launch will facilitate the researches of the biologist, and the expedition will also be equipped with two specially constructed life-boats for the use of the landing-party in case of accident to the ship which is to fetch the explorers from King Edward VII. Land early in 1909. On the return voyage, the course of the vessel will be directed parallel to the patches of coast known as Wilkes Land, and by soundings taken with the object of discovering whether there exists in this direction a continental shelf Mr. Shackleton hopes to determine the continental character of these strips of coast. For this and other purposes, there has been acquired a Newfoundland sealer, named the *Nimrod*, a vessel of 227 net tons, which has been thoroughly overhauled in the East India Company's docks at Blackwall, and rigged as a barquentine. With auxiliary engines of about 60-h.p., the *Nimrod* has a speed without sails of from 6 to 7 knots an hour. The vessel sailed from Torquay for Lyttelton, New Zealand, on August 7 in charge of Lieut. Rupert England, R.N.R., who was second in command of the *Morning* on both her voyages to McMurdo bay to carry relief to the *Discovery*. Before her departure she was inspected by the King and Queen off Cowes, and his Majesty was pleased to confer on Mr. Shackleton the Victorian Order as a mark of his interest in the expedition. Her Majesty also presented the Expedition with a Union Jack, expressing the hope that it would be carried to the South Pole. Mr. Shackleton and most of the members of the landing-party will not leave this country till October, but on board the *Nimrod* are Mr. Murray and Mr. Mackay, as well as Mr. W. A. R. Michell, the ship's surgeon and zoologist. It is anticipated that the voyage to New Zealand by the Cape route will occupy about four months, and during that time, as well as at later stages of the expedition, important magnetic and oceanographical work will be carried out on board. Every 500 miles the ship is to be "swung" for variation, not only on the outward and homeward voyages, but on voyages along the trade routes in the Indian ocean that will be undertaken during the year that the exploring party is on King Edward VII. Land. Charts, chronometers, a compass, sounding apparatus, and other instruments are being lent by the Admiralty; a standard compass and sounding apparatus by Lord Kelvin; and watches by the Royal Geographical Society—while the vessel has been fitted by Mr. Shackleton with a pole compass and a special liquid steering-compass. Dr. David, professor of geology in Sydney University, has promised to accompany the expedition from Lyttelton to King Edward VII. Land, and advise the geologists of the landing-party as to the best means of pursuing their labours.

GENERAL.

The Ninth International Geographical Congress. — Further details respecting the organization of this Congress, which continues to make good progress, are given in *Le Globe*, the publication of the Geneva Geographical Society, vol. 46, No. 2, 1907. It will be remembered that the Congress is to meet at Geneva between

July 27 and August 6, 1908. At a meeting of the Committee of Organization, held in May last, it was announced that three new names had been added to the Honorary Committee, bringing its numbers up to 63. The number of delegations so far named was 48, and that of the communications offered 67. Tickets of membership had already been issued to the number of 62. The most interesting information is that relating to the proposed scientific excursions, the detailed programme of provisional arrangements being printed in full. The definitive programme will be issued in January, 1908. Ten such excursions, some of which will take place before, some after, the Congress, have been arranged for, each being conducted by a competent scientific expert. Some will occupy 8 to 10 days. Between July 20 and 25 Dr. J. Früh of Zürich will lead a party of not more than twenty, for the study of the morphological phenomena of the Alps and their foothills. Another party of the same size, conducted by Dr. Lugeon, will study the phenomena of inverted folding in various parts of the Alps, between July 17 and 25. An excursion of a week, also before the Congress, will be devoted to high-level forestry, and will be led by M. Ernest Muret. The structure of the Jura, the plateau, and the Alps will be studied under the direction of Dr. H. Schardt, the programme being divided into two sections, one before, one after, the Congress. A botanical excursion, under the direction of Dr. C. Schroeter, the well-known authority on the flora of the Alps, will occupy eleven days, from July 15 to 25. The rest will all take place after the Congress, and will mostly be of somewhat shorter duration. A study of vegetation contrasts and the technique of botanical distribution will be undertaken under the guidance of Dr. J. Briquet, and one of glacial morphology under the guidance of Prof. Brückner. Prof. J. Brunhes and others will direct attention to the contrasts between fluvial and glacial erosion, this excursion lasting from August 7 to 14; while Prof. Schardt will explain the structure of the southern portion of the crystalline Alps, between August 7 and 10. Lastly, between the same dates, a party under the guidance of Prof. E. Chaix will study the phenomena of chemical erosion, especially as displayed in the surface forms known as *lapiés*, or *Karrenfelder*, and in the Karst. Practical hints as to equipment are given, and the importance of suitable provision for the high mountain trips is insisted on. The place of meeting is particularly favourable for the arrangement of instructive excursions, and these may be expected to be one of the most prominent and valuable features of the Congress.

The Frobishers of Halifax.—Mr. H. Ling Roth's 'Yorkshire Coiners,' etc. (Halifax, 1906), includes (chap. viii.) an interesting account, illustrated by two portraits, of a doughty Frobisher family of Halifax, with data bearing on the questions of its relationship to the great Elizabethan navigator. Mr. Roth has followed up this account by two communications to the *Halifax Courier*, April 13 and 20 last, the particulars of which are drawn from the Canadian archives, Baine's edition of Alex. Henry's travels, and Masson's 'Bourgeois de la Cie. du Nord-ouest.' In his 'Voyages from Montreal . . . in 1789 and 1793,' Alex. Mackenzie, commemorated in the Mackenzie river, testifies to the hardihood with which Joseph Frobisher "braved every kind of hardship" and penetrated to 55° 25′ N. and 103½° W.; and how, later on, his brother Benjamin penetrated further west still, as far as 55° 26′ N. and 108° W. The journal, again, of the two fur-trading Alexander Henrys relates that in September, 1775, Joseph and his brother Thomas overtook him (Henry) westward of Lake Winnipeg. From Cumberland House (where, on his fatal expedition, Sir John Franklin erected a still standing sundial) Henry and the Frobishers pushed on to Beaver lake. In all, a party of forty-three, they there built a quadrangle of houses, and, in spite of a temperature 32° below zero, did some very successful fishing. Tiring of the monotony, Henry, on January 1

1776, left Beaver lake for the plains, Joseph convoying him 120 miles to Cumberland House—"a rare feat of friendship, considering the climate." Returning next April, Henry set out with Joseph Frobisher to the Churchill river. Arriving there June 15, they, together with Thomas Frobisher, made their way 450 miles farther west to the country of Lake Arabuthcow. Thence Thomas departed to the Indians' country, while Henry and Joseph proceeded to Montreal, finding it (October 15) under the protection of General Burgoyne. Joseph and Benjamin prospered in trade, became magistrates, and lived in hospitable affluence. On a visit of one of George III.'s sons to Canada, Joseph entertained him as his guest at Montreal. A foremost partner in 1819 of the North-West Company, of which Joseph and Thomas Frobisher were chief founders, was Benjamin, a son or nephew of Joseph. Taking part in a scuffle at Grand Rapid portage between the Hudson bay and North-West Companies in June, 1819, Benjamin received a blow ultimately causing his death. The connection of these Frobishers with the Elizabethan navigator is not conclusively established. The family is traced back to the birth, in 1684, of Benjamin, father of Joseph Frobisher, the father of the above-mentioned fur-traders, and of William and Nathanael. Dr. J. Martin Frobisher, grandson of William, and now residing in Leeds, possesses the coat-of-arms which his father told him had been presented by Queen Elizabeth to Sir Martin, and since handed down from generation to generation. The Frobishers of this narrative came (it is gathered) from Normanton, also the birth-place of the Elizabethan navigator.

CORRESPONDENCE.

Dr. Otto Pettersson on the Influence of Ice-melting on Oceanic Circulation.*

A GREAT part of this paper is occupied by a description of the physical and chemical condition of sea-water, which seems more appropriate to the Chemical Society than to the Royal Geographical Society.

Certain statements are, however, made, and theoretical conclusions drawn from those statements, and I propose to remark on these, and to show how far the theoretical conclusions agree, or disagree, with the ascertained facts.

It is stated on page 281 that "The Russian section of the International Investigation of the sea has discovered a bottom current along the coast bank of Novaya Zemlya, the salinity of which (35 per mille.) equals that of the Gulf Stream water in the Norwegian sea, and whose temperature is about 1°·7 or more below zero. This is the coldest and saltest water known to exist on the globe."

Dr. Pettersson seems to be unaware that Sir John Ross, in 1818, in lat. 72° 23′ N., long. 73°·7′ W., obtained a bottom temperature of −3°·6 C. On this occasion the thermometers were lowered successively to depths of 500, 600, 700, 800, and 1000 fathoms, and the temperatures obtained decreased as the depth increased.

In the same year, in lat. 66° 50′ N., long. 60° 30′ W., the temperature at a depth of 100 fathoms was −0°·9 C., at 200 fathoms −1°·7 C., at 400 fathoms −2°·2 C., and at 660 fathoms −3°·6. Farther south, on October 4, 1818, in lat. 61° 41′ N., long. 62° 16′ W., the temperature at 950 fathoms was +2°·0 C., whilst at the surface it was +4° C., the temperature of the air being +2°·7 C. The above observations were checked by Sir Edward Sabine, who accompanied Sir J. Ross on this expedition.

From conclusions drawn during the voyage of H.M.S. *Challenger*, it is evident that the results obtained in the first two observations in Baffin bay show that that

* See page 273.

area is separated by a submarine ridge from the position of the last observation eastward of Hudson strait, as also from the Atlantic.

It is stated on page 286 that the Atlantic is hydrographically an unknown sea —"a *mare incognitum*."

I cannot understand what Dr. Pettersson means by this, for the Atlantic is fairly well sounded, its deeps and ridges can be drawn with some degree of confidence, and its temperatures from the surface downwards have been ascertained in many positions. Nor has the chemical condition of its waters been neglected, as will be seen by referring to the report on the Physics and Chemistry of the *Challenger* Expedition, by Prof. W. Dittmar, F.R.S.S., of London and Edinburgh.

Dr. Pettersson experiments with pieces of ice in a small receptacle, and from the results thus obtained evolves a theory of oceanic circulation. There does not appear to be anything new in such experiments, which are much the same as those made by the late Dr. W. B. Carpenter in 1869 and 1870, after the first oceanic investigations carried out in H.M. ships *Lightning* and *Porcupine*.

Dr. Pettersson states (p. 283) that the ice-melting experiments show how a cold current is set up on the surface when ice melts, and how cold and salt bottom water is formed, which flows on until stopped by some hindrance, and then builds up into a wall of cold water against this hindrance. Also (p. 284) that in the Atlantic the ice-melting takes place in the Arctic as well as the Antarctic Regions, and thus, in this sea, cold bottom currents from both hemispheres meet below the equator.

If this theory agreed with the facts, we should expect the bottom water in the Atlantic to be of the same temperature from the Arctic to the Antarctic Regions, or, if any change occurred, as the currents flowed at the bottom towards their meeting-place at the equator, the temperature might possibly show a slight gradual increase. But this does not agree with the facts as ascertained from actual observation, for it is found that the bottom temperatures of the Atlantic differ in different areas. In the Arctic part of the Atlantic the bottom temperature is 1° C., or upwards, below zero; in the Antarctic part of the Atlantic the bottom temperature is about the same as in the Arctic; in the eastern part of the Atlantic the bottom temperature is from 2°·2 C. to 2°·8 C., in depths exceeding 2000 fathoms; whilst in the western part the bottom temperature of the North Atlantic is 2°·2 C., and of the South Atlantic 0°·4 C. to 1°·2 C., in depths exceeding 2000 fathoms; a bottom temperature of 0°·8 C. having been obtained not far from the equator in lat. 1° 45′ S., long. 30° 58′ W., in 1873, at a depth of 2475 fathoms. These differences are not gradual, but abrupt, when the depths are equal, for bottom temperatures at equal depths have been recorded as differing 5°·6 C. in a distance of 16 miles; thus in lat. 60° 31′ N., long. 8° 14′ W., the depth being 420 fathoms, the bottom temperature was found to be 0°·1 C., whilst in lat. 60° 17′ N., long. 8° 32′ W., the depth being 423 fathoms, the bottom temperature was found to be 5°·5 C.

Moreover, in the North Pacific ocean there is a fairly uniform bottom temperature of 1°·7 C. at depths exceeding 2000 fathoms, and as this ocean is shut off from the Arctic by Bering strait, it certainly proves that its low bottom temperatures are derived from the Antarctic Regions, and as in no part of the North Atlantic do there appear to be bottom temperatures within 0°·5 C. as low as in the North Pacific, it is justifiable to conclude that the cold water at the bottom in the Atlantic is derived from Antarctic sources alone; and this is further confirmed by the fact that its temperature shows a slight, though very slight, increase as its distance from the Antarctic Regions increases—that is, when the depth exceeds 2000 fathoms.

It therefore appears that Dr. Pettersson's contention that the Atlantic bottom water is derived from Arctic as well as Antarctic Regions cannot be maintained.

In a preceding paragraph it has been shown that different areas in the Atlantic

show differences in the bottom temperature at equal depths. This was apparent very early, when oceanography first began to be systematically studied in 1869–70, for the results of the temperatures obtained in the *Lightning* and *Porcupine* revealed this fact. The reason why such different results were obtained, in adjacent areas at equal depths, was not understood until the more extended investigations of the *Challenger* in 1872–76 were undertaken. During that voyage it was found that the bottom temperatures of certain seas remained constant below a certain depth, thus—

The western part of the Mediterranean has a constant temperature of	12·8° C.	below depths of	100	fathoms.
The eastern ditto ditto	13°·5	" "	100	"
" Red sea has a constant temperature of	22°·0	" "	100	"
" Sulu sea " " "	10°·3	" "	400	"
" Celebes sea " " "	3°·7	" "	800	"
" Banda sea " " "	3°·3	" "	900	"
" China sea " " "	2°·8	" "	800	"

As there was no question that both the Mediterranean and Red seas were separated from their adjacent oceans by submarine ridges, it appeared almost certain that submarine ridges must separate the other above-named seas from their adjacent oceans, and I ventured to predict, at the meeting of the British Association at Glasgow in 1876, that a submarine ridge must separate the cold water at the bottom of the Arctic basin from the Atlantic, although no indication of such a ridge had been then discovered. In 1880, and again in 1882, a complete exploration of the area between the Scottish coast and the Færoe islands was undertaken, and the submarine elevation discovered which now bears the name of Wyville Thomson ridge. This was sufficient to prove that submarine ridges must exist between adjoining areas whose bottom temperatures at equal depths differed materially, and showed how the cold bottom water of the Arctic basin was prevented from flowing into the Atlantic. Moreover, the temperature observations taken then, and subsequently, show that not only are the temperatures at the bottom constant, but that there is reason to believe that all temperatures below depths of 100 fathoms remain fairly constant, as shown in the table on the following page.

It is not, then, correct to say that cold bottom water flows on until stopped by some hindrance, and then builds up into a wall of cold water against that hindrance; but rather that when areas are separated into basins by submarine ridges, the bottom temperature in each area, cut off from the general circulation, depends partly on the height of the ridge, and partly on the mean minimum temperature of the surface over the area in question.

On p. 285 of Dr. Pettersson's paper it is stated "that in the Atlantic not only do the cold bottom currents meet in the equatorial region, but they are formed there into a mountain of cold bottom water, and that we find here an explanation of the remarkable fact that in one of the Earth's warmest localities, the Guinea gulf, where the surface temperature is 28° C., there is a temperature of 4° to 5° C. at some 100 metres below the surface. *This is probably an effect of the updrift occasioned by the ice-melting in the polar seas.*"

In the table of temperatures given below, it will be seen that at a depth of 200 fathoms the temperatures differ but slightly in positions in 60° N. lat. and in 3° N. lat., which does not look as if there was much updrift. I quite admit that the cold water at the bottom of the ocean, which is open to an area on which there is ice, will derive its low temperature from the being in constant contact with the ice, no matter whether the ice melts or not; and it is certain that if the ocean water was fresh instead of salt, the whole of the ocean, excepting a small depth below the surface, which would be affected by the radiant heat from the sun, would be at

a temperature of about 4° C., the point of maximum density of fresh water. From observation, it does not appear that the sun's heat has much effect at depths exceeding 100 fathoms; therefore, if the ocean was filled with fresh water, its temperature would probably decrease gradually to a depth of 100 fathoms, and then remain constant at a temperature of 4° C. There is no reason to believe that direct radiation from the sun has any more effect on salt water than on fresh, and therefore there seems to be no particular reason for accounting why temperatures of 4° C. should be found at depths of 100 fathoms; the point is, why do temperatures which greatly exceed 4° C. extend to depths in some cases over 1000 fathoms below the surface?

TABLE SHOWING THE TEMPERATURE, IN CENTIGRADE, FROM SURFACE DOWNWARDS, OBTAINED IN OR NEAR THE SAME POSITIONS IN DIFFERENT YEARS.

Depth in fathoms.	Position. Lat. 60° 25′ N., long. 8° 40′ W.		Position. Lat. 60° 2′ N., long. 7° 4′ W.			Position. Lat. 60° 2′ N., long. 5° 48′ W.		Position. Lat. 5° 48′ N., long. 14° 20′ W.			Position. Lat. 3° 9′ N., long. 14° 50′ W.	
	Porcupine, 1869.	*Triton*, 1882.	*Knight Errant*, 1800.	*Triton*, 1882.	*Research*, 1896.	*Knight Errant*, 1880.	*Research*, 1896.	*Challenger*, 1873.	*Waterwitch*, 1894.	*Buccaneer*.	*Challenger*, 1873.	*Challenger*, 1876.
	°	°	°	°	°	°	°	°	°	°	°	°
0	11·8	12·8	12·5	12·8	12·5	12·2	12·2	26·2	26·7	29·7	25·5	28·9
10	—	—	12·3	12·2	12·3	12·2	11·8	—	25·5	28·0	25·8	28·9
20	—	—	12·1	11·7	12·1	11·0	11·2	22·5	24·0	26·4	24·5	27·9
30	—	—	11·7	11·0	11·6	10·3	10·3	—	20·7	18·8	23·0	21·5
40	—	—	9·9	10·8	10·4	10·0	10·0	—	17·1	16·0	21·4	16·8
50	9·2	11·1	9·5	9·5	—	9·6	9·9	16·9	15·66	14·9	19·9	15·3
60	—	—	9·4	—	9·5	9·4	9·7	—	—	—	18·3	14·5
70	—	—	9·2	—	9·2	9·3	9·5	—	—	—	—	—
80	—	—	9·1	—	9·2	9·2	9·2	—	—	—	—	—
90	—	—	9·0	—	9·1	9·0	9·1	—	—	—	—	—
100	8·4	9·5	9·0	9·2	9·1	8·9	8·9	13·4	13·9	13·4	13·9	13·4
120	—	—	8·9	—	9·2	8·7	8·5	—	—	—	—	—
140	—	—	8·8	—	8·8	8·7	8·9	—	—	—	—	—
160	8·0	9·5	8·8	9·2	8·9	8·5	8·8	11·1	11·4	—	—	—
180	—	—	8·7	8·8	8·6	8·4	8·4	—	—	—	—	—
200	7·5	9·5	8·0	8·5	8·8	8·2	8·2	9·0	—	9·4	8·2	9·5
220	—	—	8·0	8·8	8·8	7·5	—	—	—	—	—	—
240	—	—	8·0	8·4	8·8	6·8	6·7	—	—	—	—	—
260	3·5	7·4	8·0	8·3	8·7	4·4	4·5	—	—	—	—	—
280	—	—	—	—	—	2·2	1·7	—	—	—	—	—
300	−0·6	0·2	—	—	—	1·4	1·8	6·3	—	—	5·4	6·5
350	—	—	—	—	—	0·5	0·5	—	—	—	—	—
400	−0·8	−1·0	—	—	—	−0·3	−0·2	4·9	—	—	4·8	5·1
450	—	—	—	—	—	−0·5	−0·3	—	—	—	1·0	—
500	—	—	—	—	—	−0·5	−0·6	4·3	—	—	4·4	4·6
600	—	—	—	—	—	−0·6	−0·6	4·2	—	—	4·1	4·4
700	—	—	—	—	—	—	—	4·1	—	—	3·9	4·3
800	—	—	—	—	—	—	—	4·1	—	—	3·7	4·2

There is no doubt that this is owing to the ocean being composed of salt water, and not fresh. Salt water, like fresh, expands with temperature, but when it is evaporated the salt remains and makes it heavier than the water beneath; consequently it sinks and carries down its heat with it. A good illustration of this is found in the last two columns of the Table of Temperatures of Sea-waters in different years. It will be seen that in 1873, when the surface temperature was 25°·5, the temperatures below the surface decreased more gradually to a depth of 100 fathoms than in 1876, when the surface temperature was 28°·9 C.—4½° higher.

The temperature of the upper water, being much lighter in the latter case, descended more slowly. In the first place, its specific gravity was 1·02324 at its temperature of 25°·5 C.; in the second, its specific gravity was 1·02210 at its temperature of 28°·9 C. At a temperature of 15°·56 C. the specific gravity would be, for the first, 1·02589, and for the second, 1·02578.

It is this sinking of the warm water which heats the water in the eastern part of the North Atlantic, raising its temperature to 4° C. at depths of over 1000 fathoms, and this water is probably derived from the outflow of Mediterranean water, over the ridge separating that sea from the Atlantic, rather than from the Gulf Stream; for Mediterranean water has a much higher specific gravity than Atlantic water, and would consequently sink when it got into the Atlantic, and convey its temperature to considerable depths. At any rate, it is only here that comparatively high temperatures exist at depths of 1000 fathoms, and it is only here that a large basin exists which discharges heated water of a higher specific gravity than that in the basin which receives it. The Japan Stream in the Pacific is similar to the Gulf Stream of the Atlantic, yet the Pacific does not show temperatures of 4° C. anywhere below depths of 700 fathoms.

So far as cold temperatures in the equatorial zone are concerned, I would draw attention to the fact that these cold temperatures are near the land off which the wind blows. The most typical instance is the west coast of South America. Here, at Callao in 12° S. lat., the surface temperature is 15°·5 C., which is the coldest surface temperature in such a low latitude in the world, and there can be little doubt that this is due to the wind blowing away the surface water and causing the water immediately beneath to rise up and supply its place, but not the water from the bottom.

Dr. Pettersson considers that the so-called cold wall between the Gulf Stream and the coast of North America is also due to a rise of the bottom water; but I would point out that the surface temperature of this cold wall rises in August to over 21° C. off New York, and to over 16° C. off the coast of Nova Scotia. It is at that time warmer than the surface water round the British Islands, although there are icebergs on the Newfoundland banks, and the surface temperature there may fall to 9° C. or under.

I think the fact that a large number of cold rivers are discharging into the space between the Gulf Stream and the coast of North America in the winter and spring has been overlooked. The rivers bring down large quantities of cold fresh water and fresh-water ice, which cannot get past the northern edge of the Gulf Stream, and which, being lighter than the ocean water, remains on the surface, and makes the so-called cold wall between the Gulf Stream and the shore. After the snows have melted and the spring freshets from the rivers are over, the surface water quickly becomes warm, and remains warm until the prevailing cold winds of autumn and winter set in, when the contrast between its temperature and that of the Gulf Stream again becomes most marked. But even in November the surface water off New York is about the same temperature as that on the west coast of the British Islands, although one is supposed to be cold, owing, it is said, to the Labrador Current, and the other warm, owing to the Gulf Stream. In my opinion, neither the Labrador Current nor this uprising of the bottom water causes this phenomenon, but simply the rivers of cold and often frozen water discharging into this area from the Chesapeake northward to the St. Lawrence.

In the *Challenger's* voyage the specific gravity of the water was 1·025 at a temperature of 15°·56 C. against 1·027 to the eastward of the Gulf Stream and 1·0267 in the Gulf Stream itself.

In conclusion, I would observe that it is impossible to evolve a theory of oceanic

circulation from one factor alone of the many factors which influence that circulation. To take into consideration the effect only of salt-water ice, and ignore fresh-water ice; the discharge of heated water of a high specific gravity from the Mediterranean basin 2000 miles in length; the effect of wind, which is sufficient to cause a variation in the level of the Baltic sea, at Kronstadt, of 13 feet; and almost as much in the river Plate; and the effect produced by barometric pressure, and the surface currents—is not the method to judge of the resultant force, which is due, more or less, to all these factors, and therefore I do not think Dr. Pettersson's conclusions can be accepted, although he certainly adds to our knowledge by the investigations he has undertaken. T. H. TIZARD.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are as a rule written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendes.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k.k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps—Eastern. *Naturw. Wochenschrift* 21 (1906): 801–808, 817–822. **Grüss.**
Naturbetrachtungen im bayrisch-tirolischen Hochgebirge. Von J. Grüss. *With Illustrations.*

Alps—Glaciers. *Riv. G. Italiana* 13 (1906): 453–467. **Toniolo.**
Riscontri su recenti oscillazioni dei ghiacciai dei gruppi Sorapiss e Cristallo nelle Alpi Cadorine (Autunno 1905) eseguiti dal Dott. Antonio Renati Toniolo. *With Maps and Illustrations.*

Alps—Historical. **Coolidge.**
Some early visits to Zermatt and Saas. By W. A. B. Coolidge. (Reprinted from the *Alpine Journal*, November, 1906, and February, 1907.) London, 1907. Size 8½ × 5½, pp. 34.

Austria—Anthropogeography. **Firbas.**
Forschungen deuts. Landes- u. Volksk. 16 (1906): 461–556.
Anthropogeographische Probleme aus dem Viertel Unterm Manhartsberge in Niederösterreich. Von Dr. Oskar Firbas. *With Maps and Diagrams.*
See note at p. 331, *ante*.

Austria—Bohemia. **Schneider.**
Ueber die Entwickelung des Kartenbildes von Böhmen. Ein Beitrag zur Geschichte der Geographie dieses Landes. Von Dr. Karl Schneider. Size 9 × 6, pp. 50. *Facsimile Maps.*

Carpathians. *B.S.G. Română* **27** (1906): 143–167. **Martonne**
Notice explicative des reliefs du Paringu et de Soarbele (Karpathes méridionales). Par E. de Martonne. *With Relief maps.*

English Channel—Tunnel. ——
Nineteenth Century **61** (1907): 173–194; *and Supplement*, pp. 136.
The revived Channel tunnel project. [By various writers.]

Europe. **Hettner.**
Grundzüge der Länderkunde. Von Dr. Alfred Hettner. I. Band: Europa. Leipzig: Otto Spamer, 1907. Size 9 × 6, pp. xvi. and 738. *Maps. Price* 16*m.* *Presented by the Publisher.* [See review, *ante*, p. 320.]

United Kingdom—Hydrology. **Baldwin-Wiseman.**
Quart. J. Geol. S. **63** (1907): 80–105.
The influence of pressure and porosity on the motion of sub-surface water. By W. R. Baldwin-Wiseman. *With Maps and Diagrams.*

United Kingdom—Ireland. *Geological Mag.*, Dec. v. **4** (1907): 17–20. **Reed.**
Notes on some coastal features in Co. Waterford. I. Fornaght Strand. By F. R. Cowper Reed.

United Kingdom—London. *B.G.S. Philadelphia* **5** (1907): 15–29. **Johnson.**
A study of London: an essay in human geography. By Emory R. Johnson.

United Kingdom—Scotland. *T.R.S. Edinburgh* **45** (1907): 407–490. **Wedderburn.**
The temperature of the fresh-water lochs of Scotland, with special reference to Loch Ness. With appendix containing observations made in Loch Ness by members of the Scottish Lake Survey. By E. M. Wedderburn. *With Diagrams.*

Western Europe—Meuse. *B.S. Belge G.* **20** (1906): *Procès-Verbaux*, 171–178. **Pohlig.**
Une ancienne embouchure de la Meuse, près de Bonn. Par H. Pohlig.

ASIA.

Central Asia. **Futterer.**
Durch Asien. Erfahrungen, Forschungen und Sammlungen während der von Amtmann Dr. Holderer unternommenen Reise. . . . Von Dr. K. Futterer, fortgesetzt von Dr. Fritz Noetling. Band ii. Geologische Charakter-Bilder. Erster Teil. Berlin: D. Reimer, 1905. Size 11 × 7½, pp. xvi. and 394. *Maps and Illustrations. Price* 20*m.* *Presented by the Publisher.* [To be reviewed.]

Central Asia. **Obrucheff.**
Expedition to the Barlik and Tarbagatai in 1905. Preliminary Report. By V. A. Obrucheff. Tomsk, 1907. Size 10½ × 6½, pp. 22. [In Russian.] *Presented by the Author.*

See note in the *Journal* for August, 1906 (p. 180).

Central Asia—Transport. *G. Ts.* **19** (1907–8): 18–32. **Olufsen.**
Samfaerdsels- og Transportmidler i Indre-Asien. Af Ole Olufsen. *With Illustr.*

China—Kiangsi. *Z. Ges. E. Berlin*, 1907: 177–182. **Wegener.**
Ueber seine Reise durch die Provinz Kiangsi. Von Dr. Georg Wegener.

See note in the August number, p. 211.

China—Kwang-si. *B.S.G. Lyon* **21** (1906): 169–205. **François.**
En mission au Kouang-si. Par le Lieut. G. François.

Gives a general sketch of the province, and discusses the French relations with it.

Chinese Turkestan. *B. American G.S.* **39** (1907): 65–77, 137–146. **Huntington.**
Lop-Nor—a Chinese lake. By Ellsworth Huntington. *With Map.*

See note in the June number, p. 674.

Chinese Turkestan and Tibet. *Globus* **91** (1907): 133–138. **Zugmayer.**
Eine Reise durch Ostturkestan und Westtibet. Von Dr. Erich Zugmayer. *With Illustrations.*

Dutch East Indies—Sumatra. **Daalen.**
Ts. K. Nederland. Aardrijksk. Genoots. **24** (1907): **204–212.**
Nota over het Alas-land. Door G. C. E. van Daalen.

India—Burma. **Wehrli.**
Zur Wirtschafts- und Siedlungs-Geographie von Ober-Burma und den Nördlichen Shan-Staaten. Von Dr. Hans J. Wehrli. (Separatabdruck aus Wissenschaftliche Beilage zum Jahresbericht der Geogr.-Ethnogr. Gesellschaft, 1905–6.) Zürich, 1906. Size 9 × 6, pp. 130. *Maps and Illustrations. Presented by the Author.*

AFRICA.

Abyssinia. *B.S.G. Italiana* **8** (1907): 323–330. **Castro.**
Un convento trogloditico ad Eccà presso Addis-Abeba. Del Dott. Lincoln de Castro. *With Illustrations.*

On a grotto, partly at least artificial, which seems to date from the early Portuguese period.

Africa—Volcanoes. *Münchener G. Studien* **18** (1906): pp. ii. and 218. **Simmer.**
Der aktive Vulkanismus auf dem afrikanischen Festlande und den afrikanischen Inseln. Von Hans Simmer.

British East Africa. ——
East Africa Protectorate. Report for 1905–6 (Colonial Reports, Annual No. 519, 1907). Size 9½ × 6, pp. 138. *Price 7d.*

British East Africa. ——
Handbook for East Africa, Uganda, and Zanzibar, 1907. Mombasa, [*not dated*]. Size 7½ × 5, pp. 300 and iv. *Map. Price 2s. Presented by the Editor.*

Canaries—Climatology. *Meteorologische Z.* **24** (1907): 64–74. **Burchard.**
Ein Beitrag zur Klimatologie der Kanarischen Inseln. Von Dr. Oscar Burchard. *With Diagram.*

Cape Colony—Orography. *B. American G.S.* **38** (1906): 593–623. **Davis.**
The mountains of southernmost Africa. By W. M. Davis. *With Map and Illustrations.*

Congo State. *B.S.R.G. Anvers* **30** (1906): 5–26. ——
Manifestation en l'honneur des Explorateurs belges au Congo, 20 Janvier, 1906.

This paper is followed by sketches, supplied by distinguished explorers, of the course of discovery in different parts of the Congo basin, and also by biographical notices of the principal travellers.

Congo State—Ethnology. **Halkin.**
Prof. Joseph Halkin. Quelques peuplades du district de l'Uelé (État Indépendant du Congo). Monographies ethnographiques. Fascicule I. Introduction. Les Ababua. Liége. 1907. Size 10 × 6½, pp. 156. *Map and Illustrations. Presented by the Author.*

Congo State—Railway. *Mouvement G.* **24** (1907): 97–101. **Wauters.**
Le Chemin de fer des Stanley Falls. Par A.-J. Wauters. *With Map and Portrait.*

The portrait is of M. Adam, the chief engineer.

Congo State—Railways. *Mouvement G.* **24** (1907): 133–137. **Goffin.**
Le chemins de fer du Congo. Par L. Goffin. *With Sketch-map.*

Congo State—Railways. *B.S.R.G. Anvers* **30** (1906): 114–126. **Thys.**
Les chemins de fer au Congo. Par le Colonel Thys.

Egypt—Fayum. *Survey Notes* (Cairo) 1 (1906): 10–15. ——
The Salinity of Birket-el-Qurun. By A. L.

Egypt—Public Works. **Garstin.**
Report upon the administration of the Public Works Department in Egypt for 1905. By Sir William Garstin. Cairo, 1906. Size 11 × 7½, pp. 356. *Illustrations and Diagrams.*

French Congo. *Quest. Diplomatiques* **22** (1906): 713–731. **Cambier.**
Le Congo français. Ses ressources, son avenir, ses projets. Par Lucien Cambier. *With Maps and Diagrams.*

The author was at the head of the recent railway survey (see vol. **29**, p. 347).

German East Africa. *Ymer* 1906: 363–382. **Sjöstedt.**
Kilimandjaro-expeditionens allmänna gång och resultat. Af Yngoe Sjöstedt. *With Illustrations.*
On the Swedish expedition of 1905.

German East Africa. *M. deuts. Schutzgebieten* 19 (1906): 294–304. **Weule and Jäger.**
Bericht über die landeskundlichen Expeditionen des Herren Prof. Dr. Karl Weule und Dr. Fritz Jäger in Deutsch-Ostafrika.
See note in the February number (p. 226) and April (p. 457).

German South-West Africa. *M. a.d. Deuts. Schutzgebieten* 20 (1907): 1–84. **Ottweiler.**
Die Niederschlags-Verhältnisse von Deutsch-Südwestafrika. Von Dr. Emil Ottweiler. *With Maps and Diagrams.*

German South-West Africa. *Deutsches Kolonialblatt* 18 (1907): 33–34. ———
Das Minengebiet von Tsumeb.

Gold Coast—Ethnology. **Vortisch.**
Globus 89 (1906): 277–283, 293–297; 90 (1906): 232–237, 249–253.
Die Neger der Goldküste. Von Dr. H. Vortisch. *With Illustrations.*

Kamerun. *Globus* 91 (1907): 1–6, 26–32, 44–47. **Hutter.**
Bamum. Von Hauptmann a. D. Hutter. *With Illustrations.*

Morocco. ———
Treaty Series, No. 4, 1907. General act of the International Conference at Algeciras relating to the affairs of Morocco. April 7, 1906. London, 1907. Size 9½ × 6, pp. 78. *Price* 4*d.*

Morocco—Atlas. *C.R.A. Sc., Paris* 144 (1907): 105–107. **Kilian and Gentil.**
Sur l'Aptien, le Gault et le Cénomanien et sur les caractères généraux du Crétace inférieur et moyen de l'Atlas occidental marocain. Note de W. Kilian et Louis Gentil.

Niger—Historical. *Scottish G. Mag.* 23 (1907): 58–72. **Johnston.**
The Niger basin and Mungo Park. By Sir Harry H. Johnston. *With Map.*

Nigeria. **[Egerton.]**
Southern Nigeria (Lagos). Report for 1905 (Colonial Reports, Annual, No. 507.) London, 1906. Size 9½ × 6, pp. 50. *Diagrams. Price* 10*d.*

Nigeria. **[Lugard.]**
Northern Nigeria. Report for 1905–6. (Colonial Reports, Annual, No. 516.). London, 1907. Size 9½ × 6, pp. 130. *Map and Diagram. Price* 1*s.* 2*d.*

Sahara. *Globus* 91 (1907): 65–66. **Kleist.**
Die Oase Bilma. Von Oberleutnant v. Kleist.

South Africa—Harbours. *P.I. Civil Engineers* 166 (1905–06): 4–76. **Methven.**
The Harbours of South Africa; with special reference to the causes and treatment of sand-bars. By Cathcart William Methven. *With Map and Plans.*

South Africa—Kalahari. *Globus* 90 (1906): 299–302. **Passarge.**
Wasserwirtschaftliche Probleme in der Kalahari. Von S. Passarge.

South Africa—Phytogeography. *Sitzungsber. K. preuss. A. W.*, 1906: 866–906. **Engler.**
Beiträge zur Kenntnis der Pflanzenformationen von Transvaal und Rhodesia. Von A. Engler.
Based on personal observations during the visit of the British Association.

South Africa—Zambezi. *B.S.G. Lisboa* 24 (1906): 297–318, 344–353. **Bivar.**
Curso medio do Zambeze. (Extractos d'um relatorio.) Por Hugo Stauffengar Bivar.

South Africa—Zambezi. *J. Anthropological I.* 36 (1906): 159–169. **Lamplugh.**
Notes on the occurrence of stone implements in the valley of the Zambesi around Victoria Falls. By G. W. Lamplugh. *With Maps and Illustrations.*

Transvaal—Coal. **Mellor.**
Transvaal Mines Department: Geological Survey, Memoir No. 3. The geology of Transvaal Coal-measures, with special reference to the Whitbank Coal-field. By E. T. Mellor. Pretoria, 1906. Size 9½ × 6, pp. 60. *Map, Sections, and Illustrations.*

Tripoli—Commercial. *Österr. Monatsschrift f.d. Orient.* **33** (1907): **1–4.** ——
Wirtschaftliche Verhältnisse in Tripolitanien.

West Africa—Boundary. *Globus* **90** (1906): 284–286. **Moisel.**
Aufgaben und Resultate der Südkamerun-Grenzexpedition, 1900–1902. Von M. Moisel. *With Map.*

West Africa—Boundary. ——
Treaty Series, No. 17, 1906. Agreement between the United Kingdom and Germany respecting the boundary between British and German territories from Yola to Lake Chad. Signed at London, March 19, 1906. London, **1906.** **Size 9½ × 6.** pp. 10. ***Maps.*** *Price* **1s.** 10*d.*
See map in the April number, p. 459.

NORTH AMERICA.

Alaska. *B.G.S. Italiana,* IV. **8** (1907): 12–29, 181–200. **Almagia.**
Le presenti condizioni naturali ed economiche dell' Alasca. Del dott Roberto Almagia. *With Map.*

Alaska. *B.U.S. Geol. Surv.* **299** (1906): pp. 690. **Baker and McCormick**
Geographic Dictionary of Alaska. By Marcus Baker. 2nd edition. Prepared by James McCormick.

Alaska. *B.U.S. Geol. Surv.* **295** (1906): pp. 28. **Prindle.**
The Yukon-Tanana Region, Alaska. Description of Circle quadrangle. By L. M. Prindle. *With Map.*

Alaska—Glacial Erosion. *Popular Sc. Monthly* **70** (1907): 99–119. **Tarr.**
Glacial Erosion in Alaska. By Prof. Ralph S. Tarr. *With Illustrations.*
See note in the May number (p. 592).

Alaska—Glaciers. *American B.G.S.* **39** (1907): 129–136. **Tarr and Martin.**
Position of Hubbard glacier front in 1792 and 1794. By Ralph S. Tarr and Lawrence Martin. *With Map and Illustrations.*

Canada—Fuels. **Ells.**
Notes on the mineral fuel-supply of Canada. By R. W. Ells. (From the *Transactions* of the Royal Society of Canada, Second series, 1906–07, vol. **12**, Section iv.) Ottawa, 1906. Size 10 × 6½, pp. 267–288.

St. Laurence—Niagara Falls. *B.U.S. Geol. Surv.* **306** (1907): pp. 32. **Gilbert.**
Rate of recession of Niagara Falls. By G. K. Gilbert; accompanied by a report on the survey of the crest, by W. Carvel Hall. *With Maps and Illustrations.*
See note in the Monthly Record, *ante*, p. 335.

United States—California. *Popular Sc. Monthly* **70** (1907): 5–18. **Byers.**
The possibilities of Salton Sea. By Charles Alma Byres. *With Map and Illustrations.*
See note in the April number, p. 461.

United States—Colorado. *B.U.S. Geol. Surv.* **291** (1906): pp. 186. **Gannett.**
A Gazetteer of Colorado. By Henry Gannett.

United States—Colorado. *J. Geology* **15** (1907): 15–22. **Siebenthal.**
Notes on glaciation in the Sangre de Cristo range, Colorado. By C. E. Siebenthal. *With Illustrations.*

United States—Commercial. **Dove.**
Die angelsächsischen Riesenreiche. Eine wirtschaftsgeographische Untersuchung. Von Dr. K. Dove. II. Die Vereinigten Staaten von Nordamerika. Jena: H. Costenoble, 1907. Size 9 × 6, pp. iv. and 66. *Price* 2.50*m.* *Presented by the Publisher.*

United States—Magnetism. **Bauer.**
U.S. Coast and Geodetic Surv., Rep., 1906, Appendix 3: pp. 105–210.
Results of Magnetic Observations made by the Coast and Geodetic Survey between July 1, 1905, and June 30, 1906. By L. A. Bauer. *With Illustration.*

United States—Magnetism. **Bauer.**
U.S. Coast and Geodetic Surv. Rep., 1906, Appendix 4: pp. 211–226.
Distribution of the Magnetic Declination in the United States for January 1, 1905. By L. A. Bauer. *With Map.*

United States—Massachusetts. *Ann. de G.* 15 (1906): 443–448. **Allorge.**
Esquisse géographique du cap Cod (États-Unis). Par Maurice Allorge. *With Sketch-map and Illustrations.*

United States—Mississippi. *Science* 24 (1906): 861–866. **Hilgard.**
The Exceptional Nature and Genesis of the Mississippi delta. By E. W. Hilgard.

United States—Montana. *U.S. Geol. Surv., Prof. Paper* 50 (1906): pp. 62. **Calhoun.**
The Montana lobe of the Keewatin Ice-sheet. By Fred. H. H. Calhoun. *With Maps and Illustrations.*

United States—New Jersey. *J. Geology* 15 (1907): 39–45. **Lewis.**
The Double Crest of Second Watchung mountain. By J. Volney Lewis. *With Maps.*

United States—New Mexico. *J. Franklin I.* 162 (1906): 449–465. **Carter.**
Acoma: the Cliff City of New Mexico. By Prof. Oscar C. S. Carter. *With Illustrations.*

United States—New Mexico. **Fisher.**
U.S. Geol. Surv., Water-supply Paper 158 (1906): pp. 30.
Preliminary Report on the Geology and Underground Waters of the Roswell Artesian area, New Mexico. By Cassius A. Fisher. *With Maps and Illustrations.*

United States—New York. **Gannett and Baldwin.**
B.U.S. Geol. Surv. 281 (1906): pp. 112.
Results of Spirit-levelling in the State of New York for the years 1896 to 1905, inclusive. By S. S. Gannett and D. H. Baldwin.

United States—Pennsylvania. **Gannett and Baldwin.**
B.U.S. Geol. Surv. 288 (1906): pp. 62.
Results of Spirit-levelling in Pennsylvania for the years 1899 to 1905, inclusive. By S. S. Gannett and D. H. Baldwin.

United States—Petroleum. *B.U.S. Geol. Surv.* 282 (1906): pp. 146. **Fenneman.**
Oil Fields of the Texas-Louisiana Gulf Coastal plain. By N. M. Fenneman. *With Maps, Plans, and Illustrations.*

United States—Virginia. *B. American G.S.* 38 (1906): 741–753. **Surface.**
Physiography of Virginia. By G. T. Surface.

CENTRAL AND SOUTH AMERICA.

Argentine—Rio de la Plata. *An. S. Cient. Argentina* 62 (1906): 257–272. **Mercau.**
Canalización artificial del Río de la Plata. Por Agustin Mercau. *With Map.*
Noticed in the Monthly Record (*ante*, p. 336).

Bolivia—Andes. **Peck.**
Climbing Mount Sorata. By Annie S. Peck. (Extracted from *Appalachia*, vol. 11, No. 2.) [Boston, 1906.] Size 9 × 5½, pp. 95–110. *Illustrations. Presented by the Author.*
The writer claims to have reached 20,500 feet, or from 600 to 800 feet below the summit, but the altitude was ascertained by aneroid only.

Brazil. *Rev. I.G. e Hist., Bahia* 12 (1905): 59–91. **Amaral.**
Bahia—Espirito Santo. Limite entre os dous estados. Pelo Dr. Braz do Amaral.

Chile-Argentine Boundary. **Patron.**
Republica de Chile: Oficina de Limites. La linea de frontera en la Puna de Atacama, por Luis Riso Patron S. Segun los trabajos de la Sesta Subcomision Chilena de Limites con la Republica Arjentina ejecuta bajo la direccion del ingeniero don Victor Caro T. Santiago, 1906. Size 11 × 7½, pp. x. and 294. *Maps and Illustrations. Presented.*

Chile—Seismology. **Henríquez.**
Hormidas Henríquez. El terremoto de Valparaiso bajo su aspecto constructivo. (Valparaiso), 1907. Size 6¼ × 3, pp. 56.
Discusses the effects of the earthquake on buildings.

Chile—Seismology. **Steffen.**
Informes de la Comision de Estudios del Terremoto del 16 de Agoste de 1906;

Primera parte. Reseña jeneral sobre los elementos sísmicos mas importantes del terremoto. Por el Dr. H. Steffen. Santiago, 1907. Size 10½ × 6¾, pp. 68. *Map and Diagrams.*

Columbia—Canal. *B.R.S.G. Madrid* **48** (1906): 540–557. **Zerda.**
Canales interoceánicos de Colombia. Por el Dr. D. B. Novoa Zerda. ***With Map.***
Discusses projects for utilizing the Atrato.

Costa Rica and Panama. *B. Bureau American Republics* **24** (1906): 85–90. ——
Boundary Treaties between Costa Rica and Panama.
Ratified by the Congress of Panama on January 25, 1907 (see note in the May number, vol. **29**, p. 572, with map).

Panama Canal. *J.S. Arts* **55** (1907): 239–276. **Bunau-Varilla.**
The Panama canal—the "Lock-Canal" type and the "Straits of Panama" type. By Philippe Bunau-Varilla. ***With Maps, Illustrations, and Sections.***

Peru. *B. Cuerpo Ingenieros Minas, Peru* **42** (1906): pp. 128. **Stiles.**
Examen tecnico de las Lagunas de Huarochiri del Departamento de Lima. Por Alberti I. Stiles. *With Map and Illustrations.*

Pilcomayo River. **Lange.**
The River Pilcomayo from its discharge into the River Paraguay to Parallel 22° S. By Gunnar Lange. Buenos Aires, 1906. Size 10½ × 7, pp. 126. *Plan and Illustrations. Also maps, separate,* size 15½ × 10½. ***Presented by the Author.*** [To be reviewed.]

Tierra del Fuego. **Alboff.**
Anales del Museo de La Plata. Sección botanica. I. Essai de flore raisonnée de la Terre de Feu. Par Nicolas Alboff. La Plata, 1902. Size 14½ × 11, pp. vi., 86, and xxiv. *Portrait.*

West Indies—Curaçao. *Globus* **90** (1906): 293–299. **Krämer.**
Curaçao, nebst einigen Bemerkungen über eine westindische Reise (1899–1900). Von Dr. Augustin Krämer. *With Sketch-map and Illustrations.*

West Indies and South America. *B.S. Belge Géologie* **20** (1906): 83–161. **Van de Wiele.**
La Méditerranée des Antilles et le bassin préandin considérés comme régions d'affaisement. Par le Dr. C. van de Wiele. *With Map.*

AUSTRALASIA AND PACIFIC ISLANDS.

Marianne Islands. *Deutsche Rundschau G.* **29** (1907): 193–206. **Seidel.**
Die Bevölkerung der deutschen Marianen. Von H. Seidel. ***With Illustrations.***

New Guinea. *Z. Ges. E. Berlin* (1907): 149–165. **Pöch.**
Ueber meine Reise in Deutsch-, Britisch-, und Niederländisch- Neu-Guinea. Von Dr. Rudolf Pöch. *With Illustrations.*

New Guinea—Dutch. **Hellwig.**
Ts. K. Nederland. Aardrijksk. Genoots. **24** (1907): 200–203.
Toevoegingen tot den onderzoekingstocht naar de Oostbaai (dd. 6–25 Oct., 1906). Door R. L. A. Hellwig.

New Guinea—Dutch. **Hellwig.**
Ts. K. Nederland. Aardrijksk. Genoots. **24** (1907): 213–219.
Een landtocht naar de grens van Britsch Nieuw-Guinea van Mĕraukĕ uit, in Sept. 1906. Door R. L. A. Hellwig.

New Guinea—Dutch. **Herwerden.**
Ts. K. Nederland. Aardrijksk. Genoots. **24** (1907): 178–199.
Beschrijving van eene reis tot nader onderzoek der in de Oostbaai (Z. W. Nieuw-Guinea) uitmondende Oetoemboewe; en eerste onderzoek der "Noord"-rivier aldaar (dd. 6–25 Oct. 1906). Door J. H. Hondius van Herwerden. ***With Map and Illustrations.***

POLAR REGIONS.

Antarctic—Bacteria. **Ekelöf.**
Studien über den Bakteriengehalt der Luft und des Erdbodens der antarktischen Gegenden, ausgeführt während der schwedischen Südpolar-Expedition 1901–1904, Von Erik Ekelöf. (Separat-Abdruck a. d. Zeitschrift für Hygiene, etc., lxi. Bd., 1907.) Leipzig, 1907. Size 9 × 6, pp. 344–370.

Antarctic—Expedition. ——

Seconde Expedition Antarctique Belge. Procès-Verbaux des séances préliminaires tenues sous la Présidence de M. le Ministre d'Etat Beernaert à Bruxelles. Bruxelles, 1907. Size 9½ × 6½, pp. 14.

Arctic—Ice. **Garde.**

The State of the Ice in the Arctic Seas, 1906. Prepared by V. Garde. [Copenhagen, 1907.] Size 12 × 9½, pp. 14. *Charts.*

Arctic—Peary Expedition. **Peary.**

Nearest the North Pole. First complete report of the Peary Arctic Club's latest expedition. By Commander Robert E. Peary. (From *Harper's Monthly Magazine*, London, etc., February and March, 1907.) Size 9½ × 6½, pp. 335–350 and 497–510. *Map and Illustrations.*

Arctic—Peary Expedition. **Peary.**

Nearest the Pole. A Narrative of the Polar Expedition of the Peary Arctic Club in the S.S. *Roosevelt*, 1905–1906. By R. E. Peary. London: Hutchinson & Co., 1907. Size 10½ × 7, pp. xx. and 410. *Maps and Illustrations. Price* 21*s. net. Presented by the Publishers.*

See review, *ante*, p. 326.

MATHEMATICAL GEOGRAPHY.

Altitudes. **Schoen.**

Anleitung für die Manipulationen bei den barometrischen Hohenmessungen, mit besonderer Rücksicht auf Trassierungen von Bahnstrecken, verfasst von Joh. G. Schoen. Leipzig and Wien: F. Deuticke, 1907. Size 9½ × 6, pp. vi. and 18. *Price* 1*m. Presented by the Publisher.*

Cartography. *B.S.G. de l'Est* **27** (1906): 125-159, 301-334. **Helbronner.**

L'histoire des cartes géographiques et procédés actuels de leur établissement en haute montagne. Par Paul Helbronner. *With Map.*

Cartography. ——

Service géographique de l'Armée. Rapport sur les travaux exécutés en 1905. Paris, 1906. Size 10 × 6½, pp. 40. *Index-maps.*

Time Determination. *Riv. G. Italiana* **13** (1906): 468–475, 532–538. **Andreini.**

Quale importanza possa conservare ancor oggi la gnomonica. Del Prof. Dott. Angelo L. Andreini.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Climatology. **Gregory.**

Climatic Variations: their Extent and Causes. By J. W. Gregory. Mexico, 1906. Size 11 × 8, pp. 24.

Climatology. **Manson.**

Climats des temps géologiques: leur developpement et leurs causes. Par Marsden Manson. Mexico, 1906. Size 11 × 8, pp. 58. *Diagrams.*

Coral Reefs. *G.Z.* **13** (1907): 24–44, 92–111. **Langenbeck.**

Der gegenwärtige Stand der Korallenriffrage. Von R. Langenbeck.

Erosion. *J. Geology* **15** (1907): 113–120. **Westgate.**

Abrasion by Glaciers, Rivers, and Waves. By Lewis G. Westgate. *With Illustrations.*

Geological History. **Daly.**

The Limeless Ocean of pre-Cambrian Time. By Reginald A. Daly. (From the *American Journal of Science*, vol. 23, February, 1907.) Size 9½ × 6, pp. 93–115. *Presented by the Author.*

Puts forward the hypothesis that the unfossiliferous character of pre-Cambrian sediments is due to the absence of lime-salts from the sea-water of that period, owing to their previous precipitation through the decomposition of dead (soft-bodied) organisms. A good deal of assumption is involved.

Meteorology—Atmosphere. *Annalen Hydrographie* **34** (1906): 505-510. **Schweppe.**

Die Erforschung der höheren Schichten der Atmosphäre an Bord S.M.S. *Planet.* Von Oberleutnant Schweppe.

Meteorology—Clouds. *Meteorologische Z.* **23** (1906): 497–504. **Rheden.**
Wolkenhöhenmessungen mit Hilfe der Scheinwerferanlage des neuen Wiener Leuchtbrunnens. Von Dr. Joseph Rheden.

See note in the February number (p. 233).

Oceanography. **Ekman and others.**
Resultaten af den Internationella Hafsforskningens arbete under åren 1902–1906, och Sveriges andel däruti. Sammanfattade af Svenska Hydrografisk-Biologiska Kommissionens verkställande utskott. G. Ekman, O. Pettersson, och F. Trybom. Stockholm, 1907. Size 9 × 6, pp. 164. *Maps and Illustrations.*

Oceanography—Baltic. ——
Annalen Hydrographie **34** (1906): 265–278, 313–325, 374–385.
Oberflächenströmungen im Kattegat, Sund und in der westlichen Ostsee. *With Charts.*

Oceanography—Depths. *B.S.G. Italiana* **6** (1905): 427–444, 502–522. **Almagià.**
Sullo sviluppo delle conoscenze delle profondità marine. Di Roberto Almagià.

Oceanography—North Sea. **Dalhuisen and Ringer.**
Conseil Internat. Explor. Mer.; Publs. de circonst., No. **36** (1907): pp. 16.
Fortgesetzte Strommessungsversuche in der Nordsee. Von A. F. H. Dalhuisen und W. E. Ringer. *With Diagrams.*

Oceanography—Sea-water. *B.I. Océanogr.*, No. **88** (1907): pp. 12. **Allemandet.**
Analyses des échantillons d'eau de mer recueillis pendant la campagne du yacht *Princesse Alice* en 1906. Par G.-H. Allemandet. [In French and Esperanto.]

Seismology. *Science* **24** (1906): 545–551. **Heilprin.**
The concurrence and interrelation of volcanic and seismic phenomena. By Prof. Angelo Heilprin.

Seismology. *Beiträge zur Geophysik.* **8** (1907): 219–292. **Hobbs.**
On some principles of seismic geology. By William Herbert Hobbs. *With Maps and Diagrams.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Commercial—Communications. *Ann. G.* **15** (1906): 401–418; **16** (1907): 1–14. **Hückel.**
La géographie de la circulation, selon Friedrich Ratzel. Par G.-A. Hückel.

Commercial—Ocean Navigation. *Deutsche Erde* **6** (1907): 15–20. **Baberadt.**
Die Entwickelung der Bremer Seeschiffahrt. (Zur 50-jährigen Gründungsfeier des Norddeutschen Lloyd am 20. Februar 1907.) Von Dr. Karlfriedrich Baberadt. *With Map and Illustrations.*

Commercial—Oil-grasses. *Kew B.* (1906): 297–363. **Stapf.**
The Oil-grasses of India and Ceylon. By Otto Stapf. *With Plate.*

Commercial—River Navigation. *B. American G.S.* **39** (1907): 147–158. **Brown.**
The Movement of Load in Streams of Variable Flow. By Robert Marshall Brown.

Discusses the changes to which river-beds are subject at periods of low water, and the conditions of navigation at such times.

Commercial—Salt. *B.I. Océanographique Monaco*, No. 100 (1907): pp. 44. **Maillard.**
L'industrie des salines côtières. Par le Dr. L. Maillard. *With Maps and Illustrations.*

Disease—Beri-beri. *Philippine J. Sc.* 1 (1906): 709–764. **Herzog.**
Studies in Beriberi. By Maximilian Herzog. *With Illustrations.*

Ethnology—Esquimaux. *Ymer* 37 (1907): 15–48. **Hamberg.**
L'origine des Esquimaux et les premières populations de l'Amérique. Par Axel Hamberg. [In Swedish.]

Historical. *Münchener G. Studien* **19** (1906): pp. 102. **Ebner.**
Geographische Hinweise und Anklänge in Plutarch's Schrift "De facie in orbe lunae." Von Eduard Ebner.

Historical—Alphonse de Saintonge. *B.G. Hist. et Descriptive* (1906): 120–127. **Musset.**
La vérité sur Alfonce de Saintonge. Par Georges Musset.

A reply to M. Pawlowski's article in the same magazine.

BIOGRAPHY.

Pytheas. *Riv. G. Italiana* 13 (1906): 233–241, 297–315, 398–419, 476–484. **Rambaldi.**
Pitèa da Marsiglia. Note di Pier Liberale Rambaldi. *With Sketch-map.*

Kirchhoff. *G. Anzeiger* 8 (1907): 25–27. **Ule.**
Alfred Kirchhoff. Von Prof. Dr. Willi Ule. *With Portrait.*

Santarem. *B.S.G. Lisboa* 25 (1907): 5–24. **Eça.**
A obra scientifica do Visconde de Santarem. Por Vicente Almeida d'Eça.

GENERAL.

British Empire. ———
Published proceedings and précis of the Colonial Conference, 15th to 26th April, 1907. London, 1907. Size 13 × 8½, pp. 28. *Price 3d.*

Catalogue. ———
Catalogue of the War Office. Part I. [London, 1906.] Size 10 × 6, pp. 1308. *Presented by the War Office.*

This part consists of an author's catalogue in alphabetical order, in which are also incorporated anonymous works entered under the first word of the title, or sometimes under subjects. The other two parts will consist of a catalogue of official and other series, and a subject catalogue of all works not already so entered.

Education. *Queensland G.J.* 21 (1905–06): 61–70. **Dodge.**
The opportunity of the geographer in promoting school geography. By Richard Elmwood Dodge.

Geography. *Jahresber. Frankfurter V.G.* 70 (1905–06): 133–150. **Günther.**
Die Erdkunde in den letzten zehn Jahren. Festrede . . . gehalten von Prof. Dr. Siegmund Günther.

Geography. *Queensland G.J.* 21 (1905–06): 43–60. **Mill.**
The present problems of geography. By Dr. H. R. Mill.

Read at the anniversary celebration of the R.G.S. of Australasia, Queensland (see *Journal*, vol. 28, p. 514).

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

England and Wales. **Ordnance Survey.**
Sheets published by the Director-General of the Ordnance Survey, Southampton, from July 1 to 31, 1907.

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of 1891 Survey), 251 N.W., S.W., 252 N.W., S.W., 253 N.W., S.W., 263 S.W., 265 S.W., 271 N.W., 276 S.E., 277 N.W. 1s. *each.*

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Cornwall (First Revision), XLI. 14; XLII. 16; XLVIII. 10, 11, 14, 15, 16; L. 1, 2, 3, 5, 6, 7, 9, 10, 12, 16; LI. 5; LVII. 2, 3, 4; LVIII. 1, 2, 3, 7. **Kent (Second Revision),** XIV. 10, 14; XXII. 2, 3, 6, 7, 11; XXXV. 2; XXXVII. 8; XLV. 10; LVII. 16; LVIII. 13; LXVII. 8; LXVIII. 1, 2, 3, 6, 7, 11, 12; LXXIII. 8, 11, 14; LXXIV. 2, 5, 8, 9, 10, 13, 16; LXXV. (4 and 8), 7, (8 and 4); LXXVI. 1, 2; LXXXI. 2, 3, 4, 6, 7, 8, 10, 11, 12, 14, 15 (16 and LXXXII. 13); LXXXII. 5, 9, (13 and LXXXI. 16). 3s. *each.* **Lancashire (First Revision of 1891 Survey),** CVIII. 11, 12, 16; CIX. 2, 7, 9, 10, 11, 14, 15; CXV. 1, 2, 3, 4; CXVI. 1, 2, 5, 6. **Lincolnshire,** X. 15; XVII. 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16; XVIII. 1, 3, 5, 12, 13; XIX. 1, 2, 3, 4, 6, 7, 8, 9, 11, 12, 13, 15; XX. 11; XXX. 1; LXX. 7. **Norfolk,** LXXV. 6, 7. **Pembrokeshire** (II*a*. 16 and V. 4); V. 3; (4 and II*a*. 16); V. 7, 11, 12, 15, 16; X. 3, 4, 7, 8, 11, 12, 13, 16; XVII. 2, 3, 4, 7, 8, 10, 11, 12, 14, 15; XXIII. 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; XXVIII. 1, 2, 3, 4, 6, 7, 10, 11, 12, 14, 15, 16; XXIX. 6, 7, 11, 13, 14, 16; XXXIV. 3, 4; XXXV. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16; XLI. 3, 4. **Yorkshire (First Revision of 1891 Survey),** CCXXX. 8; CCXXXI. 9; CCXXXVII. 1; CCXLV. 2, 11, 14; CCXLVI. 4. 3s. *each.* CCXLIV. 6. 1s. 6*d. each.*

England and Wales. **Geological Survey.**

1-inch Map—New Series. Colour printed. Ammanford. 230. Solid and Drift editions. 1s. 6*d. each.* Swansea, 247. Solid and Drift editions. 1s. 6*d. each.*

6-inch Maps—Uncoloured. Brecknockshire, 48 N.W.; Monmouthshire, 12 N.W., S.W.

Sheet Memoirs—The Geology of the South Wales Coal Field.
Part vii.—The Country around Ammanford (Explanation of sheet 230). 2s. 6*d.*
Part viii.—The Country around Swansea (Explanation of sheet 247). 2s. 6*d.*
(*E. Stanford, London Agent.*)

England—London. **Land Registry Survey Department.**

Diagram of the County of London, showing plans revised by the Land Registry Survey Department, and approximate positions of lithoprints of certain revised areas. 1907. London: Land Registry, 1907. *Presented by Colonel F. P. Washington,* R.E., *Map Department, Land Registry.*

Italy. **Stefani.**

Geologische Karte der Phlegräischen Felder. Von Carlo de Stefani. Scale 1 : 75,000 or 1 inch to 1·2 stat. mile. *Petermanns Mitteilungen,* Erganzungsheft, No. 156. Gotha: Justus Perthes, 1907. *Presented by the Publisher.*

This map has been prepared to illustrate Prof. Dr. Carlo de Stefani's exhaustive article on the geology of the Phlegrean Fields which forms Ergänzungsheft No. 156 of *Petermanns Mitteilungen,* recently published.

ASIA.

Asia Minor. **Schaffer.**

Die Grundzüge der Verbindung Anatoliens und Armeniens. Von F. X. Schaffer. Scale 1 : 3,700,000 or 1 inch to 58·4 stat. miles. *Petermanns Mitteilungen,* Jahrgang, 1907, Tafel 12. Gotha: Justus Perthes, 1907. *Presented by the Publisher.*

To illustrate Dr. Franz X. Schaffer's paper "Grundzüge des geologischen Baues von Türkisch-Armenien und dem Ostlichen Anatolien," which appeared in the July number of *Petermanns Mitteilungen* for this year.

Indian Government Surveys. **Surveyor-General of India.**

Indian Atlas, Scale 1 inch to 4 miles. Sheets: 17, parts of districts Mianwali, Multan, Muzaffargarh, Montgomery, Jhang, Lyallpur, Dera Ghazi Khan, and of States Bahawalpur (Punjab) and Bikaner (Rajputana agency), 1904. 107 N.W., parts of districts Ganjam and Vizagapatam (Madras) and Angul (Bengal), and States Patna, Sonpur, Kalahandi, and Baud (Bengal), 1906.—India and adjacent countries. Scale 1 : 1,000,000. Sheet 85, part of Burma, 1906.—Bengal: Bhagalpur District, 1 inch to 1 mile, sheet 2, 1906; Saran District, 1 inch to 8 miles, 1906.—Bengal Survey, 1 inch to 1 mile. Sheets: 36, part of district Palamau, 1902; 63, parts of district Palamau and Hazaribagh, 1903: 143, parts of districts Muzaffarpur and Darbhanga, 1907; 183, parts of districts Manbhum and Hazaribagh, 1906; 209, parts of districts Sonthal Parganas, Manbhum, and Burdwan, 1906; 212, parts of districts Manbhum and Bankura, 1906.—Bombay: The Sind Survey,

1 inch to 1 mile. Sheets: 34 and 54, district Karachi, 1906. Levels in Sind, 1 inch to 2 miles. Sheets: 25, districts Larkhana and Hyderabad, 1906; 30, district Karachi, 1906; 39, part of Kalat (Baluchistan), 1906; 40, parts of districts Sukkur, Upper Sind Frontier, Larkhana and Kalat (Baluchistan), 1906.—Burma Survey, 1 inch to 1 mile. Sheets: 84^{O}, part of districts Sagaing and Pakokku, 1906; $84\frac{O}{13}$ parts of districts Sagaing, Mandalay, and Kyauksi, 1906; $84\frac{N}{4}$, parts of districts Lower Chindwin and Sagaing, 1906; $84\,\frac{M}{10\,\&\,14}$, parts of districts Katha and Shwebo, 1907; $94\frac{A}{5}$, parts of districts Yamethin and Southern Shan States, 1906; 192, part of district Shwebo, 1906; 263, parts of districts Hanthawaddy, Pegu, and Rangoon Town, 1903.—Central Provinces Survey, 1 inch to 1 mile. Sheets: 156, parts of districts Bilaspur, Mandla, and Balaghat, and Kawarda State, 1906; 233, parts of States Sirguja, Raigarh, and Odeypur and of district Bilaspur, 1906.—Eastern Bengal and Assam Survey, 1 inch to 1 mile. Sheets: 16, parts of districts Goalpara and Kamrup, 1906; 38, parts of districts Kamrup and Darrang, 1906; 70, parts of districts Sylhet and Cachar, 1907; 98, part of district Lakhimpur, 1906. Eastern Bengal and Assam: Dacca district, 1 inch to 8 miles, 1906; Mymensingh district, 1 inch to 4 miles, 1906.—Madras Survey, 1 inch to 1 mile. Sheets: 70, part of district Chitaldroog (Mysore), 1905. 74, part of district Tumkur (Mysore), 1905. 111 with part of 112, part of district Mysore (Mysore), 1900.—North-West Frontier Province, Peshawar district, 1 inch to 4 miles, 1906.—North-Eastern Trans-Frontier Survey, 1 inch to 8 miles. Sheets: 7, Sikkim and Bhutan, with parts of Nepal, Tibet, and adjacent British territory, 1906; 14, parts of districts Lakhimpur, Sibsagar, Naga Hills, Naga Tribes (Eastern Bengal and Assam), and of Singpho-Naga hills, 1905.—Punjab Survey, 1 inch to 1 mile. Sheets: 124, parts of district Multan and Bahawalpur State (Bari Doab), 1906; 298, parts of districts Rohtak and Delhi, 1906; 336, parts of district Ambala, Kalsia and Sirmur States (Punjab), districts Dehra Dun and Saharanpur (U.P.A. and O.), 1906.—United Provinces Survey, 1 inch to 1 mile. Sheets: 1, parts of district Ambala, Kalsia and Sirmur States (Punjab), districts Dehra Dun and Saharanpur (U.P.A. and O.), 1906; 129, parts of districts Kheri and Bahraich, 1906; 229, part of district Dehra Dun, 1906; 230, parts of districts Dehra Dun, Saharanpur, and Garhwal, 1906. Calcutta: Surveyor-General's Office. *Presented by the Secretary of State for India, through the India Office.*

Java. **Topographische Inrichting, The Hague.**

Topographische Kaart der Residentie Djokjakarta. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. 4 sheets. Topographische Kaart der Residentie Soerabaja. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. 4 sheets. The Hague: Topographische Inrichting, 1907.

AFRICA.

Egypt. **Survey Department, Cairo.**

Map of Egypt. Scale 1 : 50,000 or 1·3 inch to 1 stat. mile. Sheets: I.-I. N.E., Cairo West; II.-II. N.E., Nawa; II.-III. N.E., Belbeis South; IV.-III. N.E., Abu Kebir; XIV.-I. S.W., Manfalut. Cairo: Survey Department, 1907. *Presented by the Director-General, Survey Department, Cairo.*

AMERICA.

British Columbia. **Wheeler.**

Karte eines Teiles des Selkirk-Gebirges in Britisch-Columbia. Nach der Karte von Arthur O. Wheeler im Massstab 1 : 60,000. Scale 1 : 300,000 or 1 inch to 4·7 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1907, Tafel 13. Gotha: Justus Perthes, 1907. *Presented by the Publisher.*

Canada. **Dept. of the Interior, Ottawa.**

Sectional map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheet 314, St. Ann, revised to May 18, 1907. Ottawa: Department of the Interior, Topographical Surveys Branch, 1907. *Presented by the Department of the Interior, Ottawa.*

GENERAL.

World. **Harmsworth.**

Harmsworth Atlas and Gazetteer. 500 maps and diagrams, and 105,000 references. Part 19. London: The Amalgamated Press, Ltd., 1907. *Price 7d. each part.*

This part contains the following maps: Nos. 59-60, Eastern Germany; 127-128. China and Tibet; 201-202, South-East Australia.

in 1880 by the Russian savant Mushketoff, whose plucky expedition across the Macha pass is described in Supplementary Papers, vol. 1, p. 246. But Mushketoff and his companions were not skilled in the rules of mountaineering. This was also Mr. Freshfield's opinion, expressed twenty-five years ago in the discussion which followed Mr. Delmar Morgan's report on the Zerafshan glacier at an evening meeting of the R.G.S.

We also reached the Macha pass and looked upon the eastern mountains and down the small Zardoliu glacier. The Russians believed the pass to be the head of the Zerafshan glacier. This, however, is not the case, for we followed the glacier, which sweeps round in a semicircular curve to the north and north-west, until, after a walk of about 2½ miles, we stood near the foot of the steep ice-wall that supports the impassable Zerafshan col. Subsequently we crossed over the Pakshif pass into Karateghin, and penetrated to the valleys in the range of Peter the Great, where two peaks, Liuli Kharvi and Sari-Kaudal were climbed. From the Khingob valley we doubled back over the Gardani-Kaftar pass, and for a week camped on the pamir-like steppe (10,000 feet) of the valley of Tupchek, which lies embedded in the central part of that mighty chain of glacier mountains which is known by the name of Peter the Great. Here we accomplished our highest ascent, that of Atchik, estimated at 20,000 feet, though I must ask the reader to revel, like myself, in round figures, for the Russian maps contain very few heights, and the aneroid barometer aids and abets all those whose ambition is to climb great peaks. Perhaps future explorers will lower our beautiful mountain by 1000 feet or more, but until then I prefer to indulge in an agreeable illusion which does nobody any harm. So much is certain, however, that the highest summits around Tupchek, of which Atchik is but a star of the third magnitude, are well over 22,000 feet. Hence we made our way through Darwaz and into Baldjuan, where some time was devoted to the conglomerate mountains. The final section of the journey took us through various provinces of Bokhara by way of Diushambe, Hissar, Guzar, Kitab, back to Samarkand.

The map attached to this paper is of a district between the rivers Voru (which also has the names of Kshtut and Acha-Maidan) and Fan, left tributaries of the Zerafshan. These two are the most important affluents of the celebrated "Strewer of Gold," and if a rough estimate which I made is conclusive, the Fan carries more water than the Zerafshan at the point of union. Nor should that be surprising if one considers that the Fan is collected from what certainly appears to be a far greater surface of glacier mountains.

We left Varsiminar on July 26, and soon found ourselves on the dangerous cornice-paths of the Fan Darya. The Russian soldier, fond of pet names even for pet aversions, has given the name of "Balkonchiki"

for these giddy ledges. Such "balconettes" are characteristic of most Asiatic mountain roads, and reflect great credit upon the improvising skill of the inhabitants, although the traveller has more eye for their defects. But cossacks and explorers have horses, whereas the humble pedestrian praises Allah for having caused such a comfortable passage to be made by man. Steep rock-walls rise from the foaming torrent, and along their face runs the narrow shelf stuck together out of crooked sticks and rubble. Winding, climbing, descending, it seeks the best means of support, along the towering cliffs which close in the sombre gorge. One must always admire the ingenuity which can produce such makeshifts, while regretting the want of a public-spirited effort to

MOORLAND SCENERY, LAILAK CHAPDARA.

create a more solid and permanent structure. For generations these balconettes have enabled the villagers to reach the lower valleys, and for generations they have been nothing but an unbroken series of daily repairs. Every horse will do some damage at one point or another along the line, and his master is obliged to replace branches or slabs dislodged by those who went before. Thus it is mostly the travellers themselves who close the gaps and pitfalls on the way, unless they find themselves confronted by a blank wall where a long portion of the gallery has slid away into nothingness. Then gangs of men are brought from the nearest hamlet, where the caravan patiently waits for days until the damage is made good. Pegs are stuck into crevices, and stones banked up on projections to support long timbers of poplar

or thuya. Over these come branches, and the whole is finished off with a layer of big stones as flat as can be found near at hand. Everything is done up to a point when it will just do. There is only one place at every step where the hoof may rest more or less safely on the wobbly rock or between two holes; there is no margin for saving time or worry. The structure, when ready, represents the exact ratio between a natural difficulty and the human will opposed to it in this particular case. Nor does the native grumble because his path is made up of two halves; the work done by others, and his own ability to use it. For may not the traveller of to-day be one of the road-makers of to-morrow, pressed into service by the powers that be, whether Beg, Mingbashi, or Aksakal?

It was on one of these airy stages that we lost our best horse. We had just left the saddle in order to walk, when the grey mare got her foot caught in one of the rafters and fell across the shelf, only 3 feet wide, with her hind legs dangling in space. Now, a horse is an intelligent animal, but with an intellect sadly marred by nerves. We always had a rope ready for emergencies, and this we managed to throw around her neck and thereby to help her up. But instead of keeping quiet to await further developments, she struggled, fell again, and went right over the edge, almost pulling down to death a horse boy who had stepped into the coils of the slack rope. Down she went; a light grey spot, a yellow saddle-felt in the slaty, gurgling waters of the Fandarya, 600 feet below, and nothing more.

The cornices of the Fan defile are the most horrible I ever saw. Fortunately, the Mingbashi (head of a thousand; say "colonel" as an honorary title for the chief of a district) of Varsiminar gave me ten men to help us over the worst places, and sent ahead an even larger number to hide the most apparent defects. This in order that the great *turá* may report favourably at Samarkand, and, better still, shed the golden rays of his countenance upon his humble servant the Mingbashi. Of course, the *turá's* countenance is in his pocket, and silver is also taken. I never disappoint those dignified worthies, for a stately head keeper of the West (who "expects paper") easily carries five Mingbashis in the hollow of his palm. But in spite of the solemn assurance that the moon will reflect upon the meanest creatures the glory of the sun, I advise every one to shed direct a furtive ray, however small, upon the half-naked wretches toiling at the road, so as to make sure of the reflection which gratitude may kindle in their eyes.

The deep ravine of the Fan, which keeps us imprisoned between lofty precipices up to the mouth of the Yagnob, is but one of the many instances so often met with in these mountains, where a river has to cut through intervening ridges before running into the main valley or the plain. Accordingly, many valleys are quite inaccessible by what

should be the chief entrance, and are reached by passes over a lateral watershed. Thus all traffic between the province of Samarkand and the villages of the Yagnob, Pasrud, and Iskander rivers goes by way of Pendjekent, Kshtut, and the Laudan pass in order to avoid the execrable roads of the lower Zerafshan and Fan. Communication through the Fan gorge is, however, important as a very short cut from north to south, and that is the reason why a way was forced through

EROSION OF GRITTY DEPOSITS, ISKANDER DARYA.

it at all. Here goes the direct line from Hissar and Karatagh in the Khanate (Bokhara) to Uratiube in Ferghana, by way of the Mura pass, Iskander-Kul, Varsiminar, and over a small pass in the Turkestan range. A hardy traveller can cover the distance in six days, whereas a fortnight is the estimate of a journey *viâ* Denau, Derbent (Iron gates), and Kitab. Of course, the big merchant, who can calculate to a nicety how much he saves in wear and tear of man, beast, or material by following the line of least resistance in commercial topography, will always send his goods by the caravan route. If the consignments of

his Russian products are very large, he can send them from the railway station of Chardjui up the river to Termez, and thence by camel into Hissar, in which manner he avoids the customs duties of two or three frontiers, for each beg levies a tax on merchandise and cattle passing through his province. That is why English goods *viâ* Afghanistan have such a chance in Eastern Bokhara, where Russian wares cannot penetrate without having to pass many of those barriers, which are more formidable than wall of rock or water-ditch. Were a Russian-European to take his transports himself, he could pass unmolested, but native solidarity would prove more than a match for him. In Baljjuan or Kala-i-Khumb, he could not possibly rival the patience and the capital of "time" which the local retailer so richly possesses. A native wholesale purchaser, on the other hand, would be a doubly welcome prey to the beg, for such things cannot be kept secret in the bazar. There are, however, people, it seems, who have found the middle road, and to this I attribute the appearance during late years of several Caucasian Mountain Jews (Ossetes, they call themselves, of course) and Armenians in a small way of business. These have enough "cheek" to assert their supposed privileges as subjects of the Czar (such is the power of European prestige) while yet possessing the qualities of the native.

For the reason set forth above, all humbler business prefers the high mountain road, and during the summer months flows over it in a constant stream. There we meet the small trader with one or two pack-horses, the man with a donkey, or the pedestrian in search of work. To all these a shilling is a real presence and not a mere cipher of wholesale arithmetic, and to save it is well worth a quick, if exhausting struggle with the dangers of the heights. The eagles and vultures are kind-hearted fellows who only eat the dead, but the rapacious officials of the Amir skin you alive. Moreover, on the longer track the money spent at hostelries must run up to a pretty sum in the end, for one cannot keep up for two weeks what one can easily risk in a short sprint of five or six days—pace and privation. Thus we meet them; the man with the girded loins—that is to say, with his long garments tucked into his belt—striding forward with an energy which strikes us as unusual in his race; and the horse panting under a heavy load. They hurry on all day, only snatching forty winks under some eaves of rock or a noble karagatch tree during the heat of the noon. At night the wanderers sit shivering around a small fire, eating a crust of dry bread; the animal gets a few handfuls of barley brought from home, and a bunch of grass or hay which the master has collected during the ascent; then it stumbles about near the encampment to supplement this scanty diet with what it can find between the stones. In this wise they push and pant and struggle and starve until they reach the other side, where they rest and feed

up again. The reckoning is all right, and generally works out well—at least, for the man, for who sums up the horse's profit in the long run? But frequently the result is disappointing, because the preparations were inadequate. With true Oriental improvidence, some owners feed their horses insufficiently before the start, or overload them, so that many collapse near the top of the pass.

Bridges are the most important as well as the weakest spots of the mountain road, for they connect the easiest slopes. If the path comes to

KHON TAGH, FROM MORAINIC DAM IN THE PASRUD VALLEY.

an impossible precipice, it must look for the other side, and I have counted five bridges within 2 miles on the Karatagh Darya. Such as are above the level of the spring-floods enjoy a great reputation, being anchors of faith on a pilgrimage of uncertainty. One of this kind is Puli-Mulla (Bridge of the Mullah), which lies halfway to Piti, and marks the end of the worst stage of the road from Varsiminar. Whoever has learnt of its existence from the map is at first puzzled, until, having shaded his eyes many a time, he at last discovers a slender streak which

lies across a gulf between two vertical sides of water-worn limestone. As the chasm is too wide for the greatest length of home-grown timber, a cantilever of overlapping layers of blocks and beams has been built at one end, so as to project forward towards mid-stream, or rather mid-air. The gap thus shortened is spanned by three poplars overlaid with rough boards, fastened by means of bast and withes. A careful man gets off his horse and sends it on in front with a smack of the whip. Then he follows, walking gingerly across this diving-board, which sways and trembles 200 feet above the thundering turmoil of the whirlpools. Uttering a prayer of thanks, he takes a well-earned rest on the shelves of rounded rock which the eddies of diluvial times have hollowed out, and which glisten with the greasy polish of generations of travellers.

Owing to the steepness of the sides and the subsequent want of spaces suitable for irrigation, Piti, where we passed the night, is the only considerable village of the lower Fan. As the approach is over the graveyard, the horseman, whose gaze is upon the golden apricots in the foliage of the trees, may find himself upset. On the left bank of the river, opposite Piti, are outcrops of slate with a strong admixture of coal. The same coal, in good seams, occurs near Kshtut, where a Samarkand firm is trying exploitation on a large scale.

What pre-eminently characterizes the Duab mountain landscape is the regularity of the phenomena of erosion and the preservation of all the forms of detritus. Nobody can fail to observe the huge terraces of the Zerafshan, or the deep canyons which lateral streams have cut through them, and which force the traveller to climb down one side and up the other by corkscrew trails hewn out of the conglomerate. The absence of atmospheric moisture and the resulting absence of a distributed vegetation of grass or forest is responsible for this state of things. During summer and autumn the great rivers consist of almost nothing but glacier water, a fact which, by the way, is sufficient to demonstrate the great extent of glaciation. The amount of water contributed by rain or springs must be very small, and were I to hazard a guess I would say not more than perhaps 2 per cent. as far as the share coming from the Duab is concerned (the Tian Shan being richer in rain). Therefore these river-systems are made up of comparatively few lines running through barren matter. The symbol is a tree with long, gaunt ramifications, the ends of the stronger branches being glaciers, and the leaves representing snow-patches. To this let us contrast, say, the northern slope of Alpine Europe, in which case the "river-tree" must be compared to a succulent growth of innumerable capillaries which fill up and drain all the spaces between the stem and branches and between all the branches; the main channels appear embedded in a network of veins which permeate the substance through which the river is traced. The Central Asian river, on the other hand,

sends out bare and lanky shoots which are only interlaced towards the top. A formula by which we could express these different conditions would be one which gives the proportion of "(permanent) points of confluence" on a given surface. We should find then that the number of points at which permanent threads of water meet is greater with the Rhine than with the Oxus, absolutely and still more relatively. In the case of the former river, these points are not only more numerous, but also more evenly distributed over the entire area. When consulting maps a fairly large scale should be chosen, say one to a million for Europe, and larger for regions less uniformly mapped, for it is the detail which

LAILAK CHAPDARA, LOOKING NORTH.

brings out the difference in a striking manner. We see, for instance, how the tributaries of the middle Oxus pass like through trains from the foot of the mountains, hardly deigning to collect freight on the way.

All mountain-born rivers on great continental slopes are the same at their extreme ends, at the mouth, and at the highest watersheds, the mouth in all cases being a certain quantity of water discharged into a sea. Going up-stream, we observe that the greatest dissimilarity between the Rhine and the Oxus begins immediately past the mouth, and continues for a long distance above it. The German stream receives additions almost up to the very last; the lower Amu is surrounded by thousands of square miles without a single permanent brook, the

number of points of confluence is practically *nil*. After we have met the first affluent, and entered the foothills of Bokhara and passed the mountain gates, the contrast becomes less glaring. But in the Duab the distances between the nearest points of confluence decrease very slowly indeed, until the region at the snow-line is reached. Along those edges of snow, *névé*, and ice, where water leaves the solid state, the two rivers are alike, but the difference begins at once as we descend, and increases with great strides. Of the Duab we may say that the mountains fertilize the desert plains, and that the desert climbs the mountains, creeping into the highest valley. Both pass and evade each other, but where they brush against each other, we see the fruit in the gardens of Karshi and Ferghana.

In a humid and moderate climate the water remains longer on the surfaces between the permanent rivulets. Under the influence of this constant moistening, combined with the work done by the roots and acids of vegetation, chemical disintegration plays a greater *rôle*. The surfaces "rot," so to speak. The dynamic energy of a rainfall is stored or converted, and only in cases of great excess over the storing capacity of the area (forests, etc.) it concentrates a powerful effect along some line, which, however, is far away from the locality of precipitation.

How different is the action of a discharge of atmospheric water among the foothills or subalpine districts of the Duab type! The collected raindrops run quickly off the slopes of deposits in separate channels, leaving on the grit of homogeneous texture those sharp scars which represent the intermittent watercourses. Soon after the passing of the cloud everything is dry again, and the smaller particles of sunburnt lime set into a hard cement. All water is quickly confined to the small number of permanent courses, the banks of which it rarely oversteps, because the beds are deep owing to the narrow line of mechanical effect, as testified by the familiar canyon. The bare rocks suffer chiefly from the rapid changes of temperature, being blasted and chipped, as proved by the prevalence of rock-slides, and the enormous development of scree-slopes.

This linear confinement of the water in the Duab mountains is the reason why we find all friable deposits in such an excellent state of preservation. A diluvial gravel-bed may have been carried away almost entirely by the later river, but what remains of it, however little, is enough to appeal to the dullest eye, for there it stands dry, bare, and clear. It is beyond the reach of the stream, rain cannot fritter it away, no green grass mars with frivolous gaiety the austere correctness of the historical record. An eloquent example may be seen in the Fan gorge above Piti, where a mere band of a terrace clings to the vertical wall on one side.

In most places a great variety of relics and patches of different periods are found together, cleanly marked off. One may call it the

text-book landscape of post-Tertiary events, just as one might distinguish botanical, polar, or industrial landscapes.

Bound up with these atmospheric conditions is the life of the native mountaineer. The inhabitant of the Zerafshan valley has easy roads over the terraces and gentle slopes which the Caucasian may find obstructed with undergrowth and fallen trees. The one builds a precarious foothold on the bare rocks of narrow valleys where the other encounters slippery mud or waterfalls. Above the timber-line the

AT LAILAK CHAPDARA.

Sart's horse must strike his shoe into a hard substance, while that of the Suanetian walks with ease on the soft earth of beautiful meadows or struggles with the long grass. Here the crops of the villager are dependent upon an artificial supply of water, there they are endangered by a possible excess of rain.

Having thus tried to understand the things we see around us, we proceed on our journey. About an hour above Piti the river opens out a little, and riding becomes easier. Standing near the ruins of Saravat,

perched on a bold promontory of limestone, we survey the basin in which the upper Fan (Iskander Darya), Yagnob, and Pasrud unite. It is chiefly a picture of streaks, of the dipping strata which form the dominating background of the scenery. It is the desert still, and as if to advertise the fact by some striking sign, Nature has here laid out a genuine piece of sandy waste, a few acres of pure, dry, drifting sand swept together by the eddies of the valley winds.

We now take the Pasrud for our guide, and on the left bank pick our way through a maze of huge blocks of a ruddy brecciose concrete fallen from the cliff above, where one observes alternating layers and transitions from pure sandstone to rough fragments embedded in red cement. Presently the smile of a more gracious mood flits over the face of earth. On the broad floor of the valley are villages among green trees, pastures, and yellow fields. A pleasant hour of rest is spent in luscious grass under the shade of the weeping willow by the stream. This is more like some Swiss prospect. The swift current dashing against the round-backed boulders lifts a cool spray, and when we raise the eye it scans the long ridges of high mountains here and there dotted with snow, or penetrates into the depths of some wild corrie, where the light begins to fade from the tiers and screens of purple crags festooned with icicles.

After passing Margusar, the highest village, the desert claims us again for a while, because white limestone screes, which reflect the glare of the sun, descend to the river's edge. But plant-life is bravely disputing every inch of ground, as shown by the bushy fringe which partly hides the stream. Close to the water is the thirsty willow, holding and hemming the rim with a web of roots, while the more ascetic barberry, hawthorn, and similar shrubs line up behind as an advance guard to stem the flood of stones. Also some thuyas begin to appear on the slopes.

Then suddenly two buttresses come close together, and we see a mountain gate, which is the foreboding of a change, of something new, for the passage is not long, and beyond we perceive the massive build of a great peak, Khon Tagh. On approaching the neck, we find it choked with a dam of huge blocks mixed with smaller detritus, probably the result of a downfall or maybe the unloading of a glacier. Under one of the largest rocks the water has dug a subway, thus forming the natural bridge of which previous visitors have spoken. After clambering over the obstacle, we land upon the level where the upper Pasrud falls into the Surkhab. The latter is much stronger, though the valley of the Pasrud, being wider, longer, and more important in every respect (save that of water-supply), claims the honour of the principal name. Pausing to think, we realize once more how tradition scoffs at a nomenclature based solely on hydro-arithmetics. An impression of stateliness, a more engaging aspect or greater length, the presence of villages or

VILLAGE OF PITI.

LÖSS LANDSCAPE NEAR SAMARKAND.

pastures, or the direction of the road to the pass, are more convincing to the native than a cubing of the water-power. Quite well can we imagine how the first shepherds and hunters were attracted by the inviting openness of the Pasrud before they ventured into the darker recesses where the Surkhab glacier lurks in a lair of blackened slabs.

We have now reached, at about 7000 feet, the region of high pastureland laid out on the round-back ridges and spreading slopes which form the pedestal of towering pinnacles or ice-clad pyramids. The view is "Alpine," but at this time of the year we see greyish-yellow tints of dying grass, and the hard soil is discovered between the tufts of grass or the single stalks of coarser weeds. Then we realize that the air is dry, that drought has not stopped short on its ascent from the steppes. But if we were to come in spring, we should find a beautiful emerald lawn thriving under many showers and the water from the melting snow which soaks the ground. And the conclusion is that this region owes the preservation of an Alpine aspect (in summer and autumn) to its cool height, which enables the truly Alpine conditions of spring to preserve their main features to save their face—so to speak. By the time the winter snow hides this face again it has become quite shrivelled, but, thanks to the proximity of the glaciers, it was able to keep up the outward appearances of mountain freshness, while the caked and crusty stretches of the lower Fan cannot hold the soft caress of any rains. We are here on the line where the mountain air begins to gain on the desert air, just as the gardens of the lowlands mark the ground where mountain water proclaims a victory over desert air. For the desert is hot air against which the mountains wage war with ice, cold air, and water.

The place on which we stand, and where the upper Pasrud flows, is what the Tyrolese peasant calls a "Boden," an "Alpine floor," meaning a flat (alluvial) plain in a high valley. A peaty sod hides most of the underlying gravel, and the brook meanders peacefully in a setting of green sward. Grassy undulations rise towards the sides, studded here and there with the dark-green thuyas, solitary or in clusters. The birch is also seen, with silver bark and feathery crown. Cattle, mainly fat-tailed sheep, brouse the pastures, under the watchful eye of uncouth shepherds.

But we are somewhat surprised to find that agriculture has not stopped short, for we see fields. Yelling women, seeking shelter from the male gaze, and squealing children, frightened in their rustic games by our approach, proclaim the neighbourhood of a "lailak," or summer resort. Their dwellings are tumbledown hovels of stones or rag-clad wickerwork, which is to represent an apology for kibitkas. All the old men, the women, and the children are sent up here, to live on milk and to prepare the winter store of cheese, while all strong hands remain in the villages to reap the crops. Later they come up for the higher fields,

which sometimes are found at an altitude of 8000 feet. Once started under the auspices of a mild spring, the barley has a good chance, for when well on it only needs an occasional wetting, and after that there is nothing better for ripening than the dry heat that follows. The cold nights do no harm to cereals, but what keeps them down to comparatively much lower levels in our climate (after taking latitude into account) are the shivery rains and snowfalls of late summer.

(To be continued.)

A JOURNEY THROUGH THE EASTERN PORTION OF THE CONGO STATE.*

By Major P. H. G. POWELL-COTTON.

After my Northern Uganda trip of 1902–1903, I spent a year at home in preparation for a journey to the Congo State. November 2, 1904, saw me on the way to Lado, the chief station on the White Nile. In this district my principal quest was the northern white rhino, known only by a single specimen, shot by its discoverer, Major Gibbons, and eventually sent to America. My search for the animal, and for a couple of elephants standing as near 12 feet in height as possible, occupied five and a half months. During this time I made the Congo stations along the Nile my headquarters for short expeditions westward into the plain. All these posts are malarious, and swarm with mosquitoes, Kiro, the most picturesque of them all, being literally infested. In fact, the Enclave generally must rank among the most unhealthy districts of Central Africa; in one year the death-rate among the Europeans rose to over 20 per cent.

On my arrival in the latter part of December, and throughout the first fortnight of January (the dry season), the heat was intense, the thermometer standing as high as 104° at 2 p.m. in my tent. Once away from the Nile, the scarcity of water proved a great difficulty. Stagnant pools in the river-beds, fouled by man and beast, and these only at rare intervals, formed the sole supply. In the rainy season so much of the country lies under water that travelling is almost impossible. Owing to the flatness of the thorn-dotted plain, Lado hill forms a conspicuous landmark for many miles. This district is peopled by the Bari, a peculiar feature of whose huts is the floor sunk 18

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* Read at the Royal Geographical Society, June 17, 1907. Map, p. 468.

inches below the surface of the ground—a method of construction which appears particularly curious in view of the heavy rainy season.

As my caravan moved further southwards, I was struck by the numerous ruins of villages and almost continuous stretches of what had once been cultivated ground. It was evident that at no very distant date, probably before the dervish raids had devastated the country, it must have supported a considerable population. Much of the ground

A TYPICAL ITURI FOREST STREAM.

had been terraced and cleared of stones. The village sites were marked by numerous circles, some 6 yards in diameter, formed of wide, thin stones set upright, and standing some 18 inches to 2 feet above the surface. The top of each of these stones was nicked to receive the end of a roof-pool. Here and there a double circle of stones denoted a hut built after the form of the modern Abyssinian tucal, with a passage round it. Judging from a few higher stones still standing, these villages had evidently been surrounded by a palisade. At the present time the population is scanty, so that considerable difficulty is found in

provisioning the stations. The greater part of the grain for my men had to be drawn from a district several days east of the Nile, on the Uganda side.

Working southwards from Rejaf, I struck up the valley of the Kaya, where scattered settlements of nomad Bari plied the double trade of fishermen and blacksmiths. The women generally took their part in the work as well as the men. In little hollows on the flat surface of a rock, they would pound the filbert-like nuts of iron ore to powder. This was then carried to the smelting-pits near by, grass-roofed constructions shaped like the letter V and encircled in heaps of dross

A GROUP OF PYGMIES.

and charcoal. Here and there couples of men were hard at work forging hoes, one of them beating the mass of glowing metal into shape with two stones, to serve the purpose of hammer and anvil, while his companion plied the bellows. One of the blacksmiths told me that the iron ore is collected from the surface of the ground at a place ten days distant. When the hoes are completed they are taken over to the great chief of the Bari tribe, on the Uganda side, who buys them for flour.

Striking up the side of the Kaya valley, in a southerly direction, the caravan made its way on to the Kajo-kaji plateau, which lies some 1200 feet above the Nile. It is from this plateau that supplies of

grain are sent northwards by caravan to the mouth of the Kaya, and thence by canoe to Lado, and southwards to Dufile. In fact, Kajo-kaji might well be called the granary of the whole Enclave. On no part of my journey did I see ground more highly cultivated or natives more obviously contented.

As the caravan drew nearer Wadelai, I found a stretch of country which proved to be the favourite haunt, at that time of year, of not only white rhino, but bull elephants. Here I was able to realize the two chief objects of my visit to the Enclave, by securing a complete skin and skeleton of a white rhino bull and the hides of two elephants nearly 12 feet in height. One of these latter was destined for the British Natural History Museum, whose director had been trying to procure such a specimen for the last three years. The other I proposed presenting to the Tervueren Museum near Brussels. The preservation of these skins gave great trouble, but they were eventually sent off in good condition to Kampala, which place, thanks to the courtesy of the late Mr. Fowler, sub-commissioner Nile provinces and collector at Hoima, they reached in excellent time. But unfortunately, for some reason yet to be explained, the skins were afterwards detained so long that the lake-shore climate completely ruined them, to the loss of the museums and to my disgust, for there was a heavy bill of carriage to pay. When two years previously, in 1903, I traversed the country between Wadelai and Mahagi bay, at the north-western corner of Lake Albert, it was practically depopulated, for the villagers had moved over to the Uganda side. Now, to my surprise, I found new villages being established all along the route, the natives having returned to escape the Uganda hut-tax.

From Mahagi bay station we pushed our way up the hills to Mahagi proper, lying $4\frac{3}{4}$ hours from the lake and 1180 feet above it. Here, as in all the other stations I had visited, great improvements were to be seen. New brick houses had been constructed, and stretches of bush had been cleared to give place to vegetable gardens and cultivation. My route now led over the Nile-Congo watershed, a series of rolling grass hills, intersected by running streams fringed with belts of timber. My highest camp was at Mongolula, at an elevation of 5950 feet. This region is for the greater part very sparsely inhabited, and gives promise of one day becoming a valuable grazing-ground for white settlers. Through Irumu bands of natives were passing on their way to the Kilo gold-mines, where work on the alluvial deposits has been successfully commenced, some 35 ozs. of gold being washed per day.

The Ituri river, a day's journey from Irumu, forms the dividing-line between the grass land and the great forest. When my canoe had almost crossed the clear, rapid waters, 150 yards wide, I noticed on the opposite bank two miniature houses built close to the edge and

resembling in every feature the huts of the villagers. The old chief was loth to explain the object of these houses, but at length I was told that they were erected for the shade of his predecessor, who was told that he must recompense them for their labours by guarding the passage of those crossing the river. From that time, whenever a caravan was seen to approach the bank, a little food would be carried down to the ghost-houses, as a warning that the shade's protection was needed for the caravan about to cross.

The great Ituri forest, rendered famous by Stanley's remarkable journey across it, differed greatly from the dismal miasmic place of my

MAJOR POWELL-COTTON WITH TWO OF HIS PYGMY TRACKERS.

imagination, where unhealthy mists and perpetual twilight reigned supreme. Far from shutting out the sunshine, the lofty dome of interlaced branches above our heads only served to soften the pitiless heat of the equatorial sun. Myriads of little sunbeams filtered through the leaves, to settle on the undergrowth in bright patches of light, where the butterflies and birds loved to flit to and fro. In the morning, it is true, the foliage would often be heavy with dewdrops and gossamer, but before eight the sunbeams had lifted the mists from the dense undergrowth, the giant trees, and the graceful creepers that flung their fantastic coils and festoons from branch to branch and from tree to tree. It was in the early morning that one felt the hush of the great forest,

whose impressive stillness was only broken by the crackling of the sticks under the feet of our caravan. Here and there in the forest are little natural glades, called by the natives "eddos," some watered by sluggish marshy streams that almost lose themselves in the rich grass, while in others the waters rush and tumble over clear quartz sand-beds and among moss-grown boulders. Dark tunnels, worn through the undergrowth by generations of beasts on their way to water, lead down to these rifts in the dense vegetation. For it is here that the beasts of the forest, from elephant to the timid little dik-dik, come down to drink, bathe, and crop the fine grass at the water's edge.

The seasons in the forest are very ill-defined. Generally rain falls on four or five days of every week, while seven days without a thunderstorm was the longest dry period I experienced. In any big clearing, it was curious to hear a storm coming up, for the sound of the drops pattering on the leaves of the trees reached us long before the rain. The roar of a hurricane through the forest was an experience not to be forgotten. Our camp was nearly wrecked on one occasion, and a passage several hundred yards wide was cleared through the trees for a distance of some miles. In 1905 I was in the forest from the last few days of June to the first half of August, while in the following year I spent from the last week of January to the first days of August in practically the same districts. July of 1905, passed between Irumu and Mawambi, was by far the wettest month of the ten. The following July, however, spent between Makala, Mawambi, and towards Beni, was one of the driest. While the forest is damp, I came across but very few boggy places, and no large marshes. Mosquitoes are almost unknown.

The population of the forest is numerous, from the pygmies, considered to be the most savage and primitive, to the Mongwana, the followers and descendants of the Arab ivory and slave dealers, to whom a certain amount of Moslem civilization and handicraft have been handed down; and dotted about at wide intervals, the neat, well-ordered stations of the Congo Government gave evidence of a European civilization that has crushed Mongwana power and effectually abolished the slave trade.

The climate of the forest seems to have no detrimental influence on the physical development of any of the tribes who find their home under its shelter. The Mongwana are a tall, well-proportioned race of men, and many of the women seem to have inherited a certain Arab grace of form. The Babila, another tribe with which I came in contact, although short in stature, are a sturdy, healthy-looking race, while the pygmies certainly show no signs of physical degeneration. But the native from the plain, or the white man, usually suffers severely after a few months' residence in the damp atmosphere of the

forest, rheumatism, dysentery, and bilious fevers being the most common complaints.

The soil of the forest is so rich in leaf-mould that it produces two to three crops a year. Like all natives, the villagers are in the habit of continually changing their cultivation from one spot to another, although here it necessitates a great deal of labour. The underwood and saplings are first of all cut down, and then attention is turned to the smaller trees, which are felled some 8 feet from the base, and left to cumber the ground where they fall. By this time the underwood is sufficiently dry to help in the destruction of the larger trees that are

A FOREST GIANT, WITH TENT BETWEEN TWO EMBEDDED ROOTS.

alone left standing. Piling it around the trunks, the natives set it alight in order to burn the bark, and thus kill the trees, which eventually stretch out their gaunt arms over crops of banana, millet, rice, maize, sweet potatoes, and manioc.

Grass in the forest can only be found in the eddos, and in the clearings made by the natives for their gardens. For this reason there are no cows, and the few imported sheep and goats that manage to withstand the hardships of the march through the forest to the villages are cherished by the owners as their most precious possessions. Among the little flock that followed us on our journey, the death-rate in the forest was over 50 per cent., and this in spite of every care. Night

after night a platform strewn with leaves was built for them, with a roof as shelter, and during the march each animal had a nose-bag with a few potatoes in the bottom, to prevent them getting hungry or eating poisonous leaves from the undergrowth.

On the site of an abandoned garden vegetation rapidly springs up, to form a favourite haunt of elephant, buffalo, wild pig, bush-buck, bongo—an animal even rarer in the Ituri forest than the okapi—and leopards, which latter are, curiously enough, never to be found far from a native settlement. In coloration the animals of the forest have a tendency to become darker in shade than those of the plains. A notable example of this is the ratel (*Mellivora cottoni*), which is entirely black, while in the south and west of Africa the whole of the upper surface of the body, head, and tail are an ashy grey.

Mica abounds in the neighbourhood of Mawambi, and the whitewash used for the houses in the post is so full of minute fragments that the walls sparkle in the sunshine.

This station is a great centre of the pygmies. They live in small communities of six to eighteen men with their wives and families. Each group is governed by an elder, but there does not appear to be any recognized supreme chief, and the communities are often at war with one another. They have no permanent villages; their low primitive huts, thatched with the large leaf of *Sarcophrynium arnoldianum*, are built in a little clearing in the forest, and are moved, not only for their customary bi-annual migration, or when hunting in that district is becoming difficult, but also on the death of any member of the group, or when they have killed some large animal. It is easier, in the latter case, to move the village to the animal than the animal to the village. Their time is passed in hunting and collecting honey, wild fruits, and roots. While they kill the larger animals, even elephants at times, with a short-shafted, broad-bladed spear, by far the greater quantity of their game is taken by driving it into nets.

The pygmy is a most expert climber, and no matter how high the wild bees may have their nest, he will scale up and cut it out in an incredibly short space of time. Each group of pygmies attaches itself to the chief of one of the other forest tribes, whom they supply with meat, honey, creepers as ropes, and leaves for thatching, in exchange for vegetable produce. Tilling the ground is an occupation regarded with scorn by the true pygmy. Bows and arrows are his weapons of war. With these he is a skilled marksman, for he is constantly practising on monkeys and other small beasts. All the ironwork used by a pygmy is traded from other tribes. Bark cloth dyed terra-cotta or a soft grey is his principal manufacture, but he also makes wooden honey-pots, pipe-stems, bows and arrows, together with personal ornaments of fur and feather, and sleeping-mats of skin. The dances of the pygmies are the most interesting of any I have seen, and are

carried on with great energy and enthusiasm for hours at a stretch. Nearly all of them portray some feature of a hunt, and end up with the feast that follows its success.

From Mawambi we pushed on to Makala in search of okapi, for it was here that a native hunter had secured the two specimens brought to Europe by Dr. David. Makala, on the banks of the Lindi, we found to be a neat, well-ordered station off the main routes through the forest, and maintained solely for administrative purposes and the collection of rubber. An avenue lined with pineapples and bananas leads up to the post, which crowns a little slope.

FLOATING VILLAGE OF KATANGA, AS SEEN FROM THE SHORE.

The native renowned for his skill in okapi hunting was sent off immediately on our arrival at the post, in search of tracks. A few days later news was brought in that he had found and shot a fine male okapi. In addition to my disappointment at thus losing a chance of shooting it myself, there was the difficulty of getting in the beast from the place in the forest where it lay, and dealing with the skin before it was too late. However, by dint of working on it nearly all one night, I managed to preserve it well enough for it to be considered one of the most perfect specimens that has yet reached Europe. It is now to be seen, together with the complete skeleton, at the Natural History Museum, South Kensington.

Still in hopes of shooting a specimen myself, I searched the neighbourhood; but in spite of hours spent in following fresh tracks, I never

so much as caught sight of an okapi. Indeed, the chances of a sportsman coming across these extremely timid denizens of the forest undergrowth seem to me to be very remote.

Makala is one of the great rubber centres of the Congo, and during our sojourn of three and a half months in the district, we had unrivalled opportunities of studying the method of rubber-collection. This apparently varies considerably in different districts. At Makala, each hale adult man has to bring in 5 kilos per month, and this can be collected in forty working hours. Payment is at the rate of 30 centimes per kilo, of which 10 per cent. is given to the chief, and the balance to the actual gatherer.

In the end of June, we made our way slowly back through the forest to Beni. Kokomeangle, a hill four marches from that post (3450 feet elevation), commanded a fine view over an immense stretch of forest, and in the early dawn, before sunrise, a splendid panorama of the snow-clad range of Ruwenzori.

At the north-west corner of Lake Albert, we were camped for several weeks. Before midday a high wind would spring up, blowing from the slopes of Ruwenzori towards the lake, and continue till four or five o'clock in the afternoon. This would often disperse the dense clouds of small flies that hung over the lake, sometimes looking so like the smoke of an advancing steamer, that it was hard to realize none were yet plying on the lake. The water is slightly brackish, and much of the reed-fringed shore is formed of minute shells. It was at this camp that I shot a specimen of the Semliki buffalo, a red variety of the Cape species.

At Katwi we passed the curious crater-lake where a considerable salt industry is carried on by the natives. Besides the almost daily caravan to Fort Portal, this salt finds its way far into the forest and southwards almost to Tanganyika. If this salt deposit passes to the Congo, as the result of the corrected Anglo-Congo boundary, it will probably be exploited under European supervision, and prove a valuable asset to the State.

Continuing our journey round to the eastern side of the lake, we reached Kissegnies, the main camp of the Congo Geographical Mission for the demarcation of the 30th meridian. To Commandant Bastien, the officer in charge, we are indebted for much courtesy, more particularly for his care of me when I was mauled, on the banks of the Sassa, by a wounded lion.

Katanga was the most southerly point we touched. This village was one of the most curious I have ever visited. The main group of thirty huts were built on one huge floating platform some little distance out on the waters of a sheltered bay. The platform rises and falls with the surface of the lake, being moored by poles driven into the mud. The villagers are a robust, well-built race, in spite of constant inter-

marriage, for the men never choose their wives from among the women of the plains. They subsist by hippo-hunting and fishing, carrying on a lucrative trade by the purchase of salt from Katwi, to exchange for sheep at the southern end of the lake.

By the Toro-Entebbe route, we returned to Mombasa, and thence home, after a twenty-seven months' trip. The chief scientific results of the journey are—(1) Several good specimens of the northern white rhino. (2) An okapi skin and skeleton. (3) Six new mammals, viz. (*a*) A water-chevrotain, ***Dorcatherium aquaticum cottoni***; (*b*) the Central African ratel, ***Mellivora cottoni***; (*c*) the dusky African tiger-cat, ***Felis chrysothrix cottoni***; (*d*) an elephant shrew, ***Rhynchocyon stuhlmanni nudi-***

THREE HUTS OF THE FLOATING VILLAGE, KATANGA.

caudata; (*e*) a black-and-white monkey, ***Colobus palliatus cottoni***; (*f*) the Semliki red buffalo, ***Bos caffer cottoni***. Some 8000 lepidoptera, among which several new species have already been described, a number of ethnological objects, some phonographic records, and about seven hundred photographs complete the list.

In conclusion, I should like to add that my journey was only rendered possible, firstly, through the goodwill of Sir Constantine Phipps, our minister at Brussels at the time I started; secondly, by the kindness of the Egyptian and Sudanese officials, who took the greatest interest in my expedition, and did all in their power to make the passage of myself and my equipment easy through their country, as well as to ensure the prompt return of all the specimens sent back that way; lastly, and most

important of all, I am indebted to the courtesy of the Congo Government, who not only gave me permission to travel and shoot through the game reserves on their eastern border, but allowed me to take my own armed escort from Uganda. Almost throughout I received every attention and assistance from the Congo officials, many of whom put themselves to great personal inconvenience in order to give me greater comfort.

The PRESIDENT: I have to introduce to you the lecturer of the evening. Major Powell-Cotton is one of the most notable and best known of those travellers who have been led into exploration by an intense love of sport and by a great aptitude for natural history. His first important expedition was in Western Tibet some eighteen years ago. I believe he visited Tibet twice. He travelled in Somaliland in 1895–6, and afterwards in Abyssinia. In 1903 he travelled in Northern Uganda, and an account of his journeys there was given to us early in 1904. In November of that same year, he started for his later journey, which he will describe to-night. He remained partly in the equatorial forests and partly in the eastern part of the Congo for twenty-seven months, and during those long twenty-seven months, as during all his previous journeys, he made very large and important collections in natural history. That is the principal feature, I may say, of his life's work.

After the paper, the PRESIDENT: I will ask Mr. Lydekker, the distinguished zoologist, if he is present, to say a few words.

Mr. LYDEKKER: I think I may speak on behalf of the Natural History Branch of the British Museum as to how much it is indebted to Major Powell-Cotton for having brought the first male okapi. It is not only the first male specimen the museum has received, but it is the best okapi-skin, the taxidermists tell me, that has been brought to this country. Those who have been in the tropics know how difficult it is, especially when marching, to preserve skins, and it is a great triumph for Major Powell-Cotton to have brought this specimen home in such splendid condition. I am not going to weary you with a dissertation about the animals collected by Major Powell-Cotton, and will confine myself to a few remarks about okapis. It has been hitherto thought that in the case of big game animals from the same district all individuals were alike; but with these okapis, so far as we know at present, this is not so. Thus the specimen Sir Harry Johnston brought home has very large white knee-caps; but in Major Powell-Cotton's specimen there are none at all, the knees being absolutely black. The Alexander-Gosling Expedition has presented another specimen to the museum, also a male, which has small white knee-caps, and also differs from all others I have seen in other respects. The black stripe, for instance, that extends from the knee to the fetlock is usually complete, but in the specimen brought home by the Alexander-Gosling Expedition it stops short so as to leave a white gap above the fetlock-band. These three specimens are altogether different, and if we had been dealing with any other animal I think we should have said they were distinct races; but the curious fact is that out of some ten or fifteen specimens, at least nine or ten seem more or less distinct from one another. Of course, these okapis have attracted a great deal of interest, and every specimen brought has been mounted and exhibited. If the differences prove to be connected with locality, they will indicate distinct races; but if, as I think, they are, so to speak, accidental, we must amend our conception of the colouring of big animals. It is most peculiar that the striping is restricted to certain parts of the body and limbs, because in many large animals, like most zebras and tigers, it is

general. In the cases of tigers and zebras, there is no question that the striping is to break up the solid form of the animal so that it appears invisible at a distance; and I think that in okapis the striping, especially when they are lying down, is intended to break up the outline of the lower parts, while the upper parts are concealed in the thick forest. Some of the other animals Major Powell-Cotton brought home and gave to the British Museum are peculiar from their dark colouring, and I have named two as distinct races.

Mr. Douglas Freshfield: I have little to say to-night. This is a naturalists night, and we all of us look at the things we are most interested in. We have heard, and I hope we shall hear a good deal more, of the strange animals and strange vegetation around Mount Ruwenzori and Lake Albert Edward. I missed any description of the remarkable mountain scenery about Lake Albert Edward; I came quite unprepared for it, and it seemed to me to compare favourably with that of the Italian lakes. Nothing could be more picturesque than some of the villages that lie on the lake-shores. In the north-east bay there are islands, and into it falls one of the few beautiful rivers, the only beautiful river except the Nile one sees in Uganda. Its banks and waters harbour water-fowl of all sorts. When the Cape to Cairo railway (which we all talk about, but which I am afraid many of us will not see) does come into existence, Lake Albert Edward will probably become a resort for tourists; there will be a hotel on its shores, and huts for mountaineers off Ruwenzori. I shall not detain you any longer, but I hope we may hear a good deal from Mr. Wollaston, who has travelled from Lake Albert Edward through the Mfumbiro volcanoes down to Lake Tanganyika, of the scenery of the north end of which he speaks enthusiastically.

Mr. R. B. Woosnam: In calling upon me to-night, I must say you have taken me entirely by surprise; I did not anticipate being asked to speak; for although it is true that on our way across Africa after leaving Ruwenzori we did pass through the heart of the Congo forest, still our journey was made so quickly—from Uganda to the west coast in seven weeks, with only three days' delay—that I do not feel inclined to give any opinion, or even to discuss Major Powell-Cotton's charming lecture. But I feel there is one thing I can and must do, and that is bear a tribute of praise to the lecturer; indeed, I feel as if I had just awakened from a delightful dream, in which I passed again through Uganda and through the Toro district, along the eastern slopes of Ruwenzori, and across the Mubuku river, which I feel sure is the one Major Powell-Cotton referred to as the shifting river, and on through the arid country in the upper part of the Semliki valley to Fort Beni, where we had the pleasure of meeting Major Powell-Cotton; I heard again all the familiar sounds, and saw the familiar sights. At one camp—I have forgotten the name—when we were staying there, in the ordinary course of the day's march, the natives brought us in the skin of an okapi, but unfortunately it was in a very bad condition; it had no skull and no feet, and in skinning it they had cut away the skin of the forehead. They wanted a high price for it—a measure of about 40 yards of cotton-cloth and two sheep, and as I hoped to return some day to the Congo, I did not feel inclined to pay that price for three-parts of an okapi-skin, and therefore we left it. As to the distribution of the okapi, it is difficult for any one to say at present; they seem to be distributed all over that part of the forest which is contained within a circle whose circumference cuts Stanleyville, the Welle district, and some point considerably south of Ruwenzori. When we were at Trumu, we heard native reports of the okapi being found almost on the edge of the forest. We did not find any trace of it in the Ruwenzori forest, although there is no doubt it is connected with the Congo forest, because the Congo forest comes across the central part of the Semliki valley, and stretches up on the lower slopes of Ruwenzori, and

so joins the forest which goes in a belt right round the mountain. I can only corroborate, as far as we were able to see, exactly what Major Powell-Cotton has told us in regard to the natives and pygmies in the forest; and some of the things he told me when we were at Beni I was able to identify in the forest. I can only thank him for the very delightful and realistic account of the Congo forest which he has given us to-night.

Mr. WOLLASTON: It is very hard to make comments on Major Powell-Cotton's most interesting paper, and I am not really entitled to do so, because I did not go through his country. He went down into the Ituri, and I went in a different direction. Mr. Carruthers and I went down by Lake Albert Edward to Lake Kero, then to Tanganyika, and on across to Kasongo, on the upper waters of the Congo. I was interested to hear Mr. Freshfield say that coming on to Lake Albert Edward was like the first view of Lake Garda, because my first view of Lake Tanganyika reminded me of Lake Maggiore. It has very much the same appearance, the same colour, and the same shape. About these okapi and the other things, I am not competent to speak. There was one thing that struck me in Major Powell-Cotton's lecture. A great many of his photographs are of Congo State posts and soldiers and officials. I know that Major Powell-Cotton visited many of the posts, and was hospitably received by them. Mr. Carruthers and I were also very hospitably received on many occasions when going down through the Congo.

Major POWELL-COTTON: I do not think there have been any points raised in the very interesting discussion we have heard which require any words from me. I have collected a good deal of information about the habits of the okapi, and at some future time I may perhaps put it in a form which you can read, if you care to. I thank you very much for the very kind way in which you have listened to my brief account of my travels.

The PRESIDENT: I think it is unnecessary for me to tell Major Powell-Cotton that he has given us great pleasure to-night. It is always easy to detect when a lecture is interesting to an audience, and we now thank him most heartily.

JOURNEYS IN NORTH MESOPOTAMIA.*

By MARK SYKES.

HAVING glanced at the general characteristics, we may now proceed to examine the Kurds in detail. All along the northern slopes of the Karaja Dagh we have a collection of tribal and non-tribal Kurds of the lowest type and description, nomads and semi-nomads. They are all despicably cowardly, dirty, cruel, and apparently idle, and I am afraid that many travellers, generalizing from these particularly odious people, condemn the whole race, when, as a matter of fact, like the Kurds north of Lake Van, they are an exception to the rule.

Between Urfa and Birijik we find a wonderfully different people in

* Read at the Royal Geographical Society, March 11, 1907. Continued from p. 254.

the tribes of the Dinardieh and Berazieh. These are turbulent politicians, bold warriors, wealthy herdsmen, and industrious agriculturists. The Berazieh and Dinardieh, although they have adopted Arab dress in the majority of cases, are pure Kurds, and are an excellent example of what a useful economic asset the Kurd is when his energies are turned in the right direction. There are now some 360 prosperous villages in the vicinity of Seruj, and these are inhabited by people who only a comparatively few years ago were mostly dwellers in tents.

In the vicinity of Harran, there are many villages of mixed Arabs and Kurds; however, as they have practically no tribal organization and no leaders, their lot is unfortunate, but, although non-fighters like the Fellahin Arabs, they are far more industrious and persevering.

We now come to the southern slopes of the Karaja Dagh. This section of the country is entirely in the hands of Ibrahim Pasha, the great Hamidieh noble and chieftain.

Ibrahim Pasha is, without a doubt, the most interesting person in the Jazirah. When he started life ten years of age, his father was a prisoner in Diabekir, and he himself a penniless refugee in Egypt. He now stands out a brigadier-general in the Turkish army, the master of fourteen thousand lancers and horsemen, the leader of twenty-two distinct tribes, and chief of the Milli Kurds. His photograph will give you some idea of the man. Ibrahim Pasha's mother was an Arab of the noblest race, his father a Kurdish chieftain of renown. In Ibrahim we find the

IBRAHIM PASHA.

JACOBITE OF TUR ABDIN.

racial characteristics of both his parents—the constructive and practical powers of the Kurd combined with the mental faculties and humanity of the Arab. Ibrahim is a man with many enemies, his position requires him to be at constant war with his neighbours, the Arab and Kurdish tribes without his confederation long to see him killed, but I have never heard any one accuse him of a disgraceful or dishonourable act. Indeed, although he has personally no bias in favour of the Armenians, he did not hesitate to threaten to destroy Suverek if they were massacred there, and so saved hundreds of lives; and when matters were at their worst at Diabekir and Urfa, he actually succoured some thousands at his head-quarters at Veranshehr. For two months he fed these people for nothing, and when the troubles subsided, he gave such as chose to remain lands on which to live and work in peace. I am sure no one can grudge him the wealth which his action has brought him, and his statement that the terms he imposes on settlers in his country are not unreasonable is proved by the fact that Armenian immigrants are increasing at Veranshehr every year.

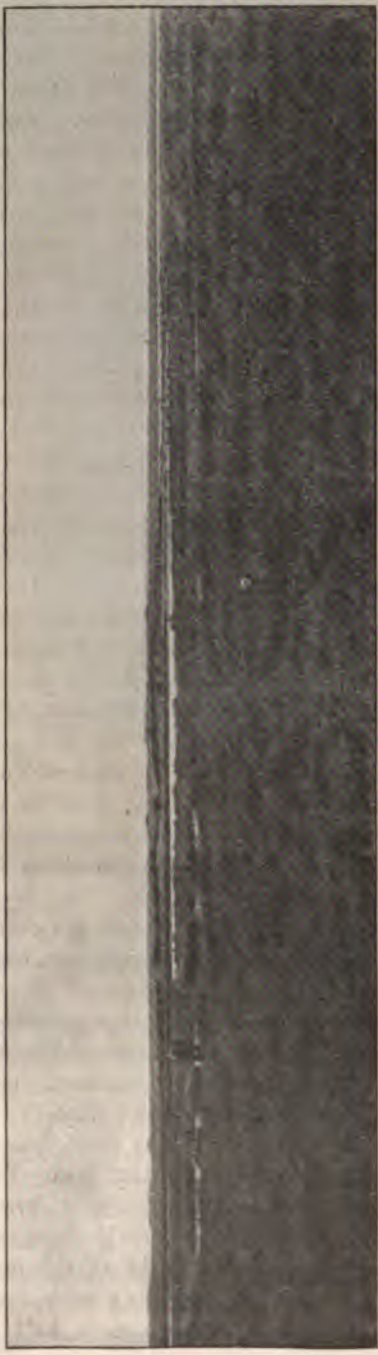
Leaving Ibrahim, his tents, and flocks behind us, and proceeding eastward, we come to the stony region of the Tur Abdin, inhabited by a peculiar population whom people usually divide into two classes—Jacobite Christians and Kurds. As far as I can ascertain—but there may be others who will correct me—the people of the Tur Abdin, both Moslem and Christian, are really of one race, and that race is Kurdish. These people are divided into several tribes; some talk Kurdish, others a bastard dialect of Arabic. But this has no bearing on their religion; in such tribes as the Christians preponderate there are Christian chiefs, in others Moslems. These tribes are singularly different from their neighbours, in that they seem to have lost the art of fighting for an indefinitely long period without any appreciable result. The men of Tur Abdin have taken of late years to killing one another off irrespective of creed, and, not content with killing, they burn and destroy each other's property in the most ruthless manner; consequently villages are growing scarce between the plain and Midiat, and until some sharp examples have been made the mischief will continue. However, north of Midiat, and until one reaches the unpleasant zone of the Diabekir plain, we find a well-populated region of passing richness. One of the tribes inhabiting it are known as the Mahalemi. These people, who speak a base Arab dialect, according to their own tradition were Christians, but became Moslems two hundred years ago because their patriarch would not grant them a dispensation to eat flesh in Lent during a year of famine. Before leaving Tur Abdin, I would draw your attention to one of the interesting monasteries which remain. In the one at Deir Amar there are some admirable mosaics; the roof is tiled after the manner of Roman buildings, and even as the modern Turkish houses in Anatolia are roofed to-day. I might add that it seems to me interesting that in the villages in which Christians preponderate the round arch is still adhered to in building, while where Moslems are in the majority it is replaced by the pointed arch.

Between the Tur Abdin and Jezire-ibn Omar we find the camping-grounds of the Miran Kurds, a tribe lately of some importance, but now waning in power and prestige.

On the northern side of the Jebel Sinjar there is a peculiar salt marsh known as the Sea of Khatunieh; in the centre of this marsh here is an island connected with *terra firma* by a causeway. On the island there is a warren-like village inhabited by Arab fellahin.

The village of Khatunieh is, I think, one of the most depressing spots I have ever visited, for its situation is gloomy and dreary beyond belief. The hills in the background are of a snuff-coloured yellow; the dull, brackish waters of the lake are darkened by rank black sedges, through which rustle an evil-smelling wind, heavy with the fume of salt marshland; while the village itself is in keeping with its surroundings, being only a collection of tumble-down huts, half built,

half dug out of the ground, more like the lairs of wild beasts than the dwellings of human beings. Around the holes through which the inhabitants creep into these burrows, is collected the filth and rubbish of years, reeking with a sickening odour of decay. The miserable wretches who call these dens their homes are of the lowest of their race: diseased, poor, avaricious, and of such low mental calibre as to be almost half-witted. It would be hard to imagine more depressing company after a long and tedious journey. Yet they were loquacious, even beyond the wont of Arabs, and, chattering like apes, would give neither rest nor peace to me or my people until driven away by force.



ISLAND OF KHATUNIYEH.

Having now described the inhabitants of the western and northern portions of the Jazirah, I will now turn to those of the south-east — the devil-worshippers of the Sinjar. This singular people, whom I have been privileged to visit, I really can lay claim to know very little about. The reason, I think, will be plain if I read to you my diary.

"The next morning we set out once more for the Sinjar, and after four hours' ride at length reached the foot of the Sikeniyah pass. I always understood that the Yezidis who inhabit the mountain were a much-maligned people, groaning under a cruel oppression, and so on; brave, courteous, industrious, with an ingrained love of freedom, and possessed of all the rest of the stock-in-trade virtues. My experience, however, does not encourage me to put much faith in the theory.

"Soon after we entered the pass, we were unpleasantly surprised by seeing four men in white garments, armed with rifles, spring apparently out of the ground and brandish their weapons in a threatening

YEZIDI VILLAGE NEAR EL KHAN.

manner. An old man on a distant hill, however, shrieked out some words in a devilish tongue, and the four men vanished as quickly as they had appeared. A little further on the trick was repeated. The men were wild-looking ruffians, with a lowering look of animal ferocity in their eyes that might well give one cause to think whether one had been wise to visit this nest of Satan's brood.

"After an hour's anxious ride we reached a small encampment. Not a word of welcome was vouchsafed us. As I ate my lunch, a savage-looking man snatched the food out of my plate and wolfed it without a word. On every hill white figures flitted about, crying shrilly and pointing to my party. My escort looked doubtful and anxious. Presently a tall sombre man came up and spoke to us in Arabic. He was

a shaykh. 'Go,' he said. 'I will go with you. Go on quickly; you will bring trouble to us if you stay, and trouble to yourself. Mount and be off.' We took the fellow's advice and started away, the shaykh accompanying us.

"As we passed a second encampment, a strange-looking creature came out towards us, shouting, 'Khoweh! khoweh!—Tax! tax!' He seized the bridle of one of the horses, and stopped the caravan. The people were streaming from the encampment, whistling a signal to others, who came running from the fields. 'Pay him,' said the shaykh; 'there is danger!' With great reluctance we gave the brute some money, and rode on as quickly as we could. Nor did we draw rein until we reached the camp of Khalil Agha, a chief of some note amongst these people. Khalîl Agha, a man with a strange and evil countenance, received us with a chilly reserve that gave us but little encouragement after the preceding events. As I sat in the Agha's tent, scores of his white-robed henchmen came in and glared at us in grim silence. Strange-looking fellows were these Yezidis. Their features are so small and pinched that their faces have an appearance almost asp-like. Their expression is predatory and vindictive. The fact that their noses being generally neither straight nor hooked, but pointed and turned downwards, so as to press down on to the upper lip, adds to the unpleasantness of their countenance. Their voices are shrill and fierce, their manners brusque and unceremonious, their bodies are lithe, active, and wiry, and in stature they tend to be above the average. Their clothing is strange in the extreme. On the head, a tall brown conical cap, around which is wound a black or red turban; the body is swathed in a long flowing shirt of white, cut square at the neck; a short cloak of brown leather, and pointed curled-over shoes complete the costume. When I saw these curious figures around me, it seemed as if four thousand years had slipped back, and I was sitting among some forgotten primæval people, such as those who carved their barbarous monuments upon the rocks at Ivriz.

"There is an air of mystery about the Yezidis, which may well account for all the monstrous tales that are told of them. As I sat in the tent, a man in black robes entered and sat down opposite. Great reverence was paid to him, many of the men kissing the hem of his garment. What or who he was, I could not learn. Presently I left the Agha's tent and went to my own, where I found a crowd of silent men slowly and deliberately examining all my furniture, while the soldiers and muleteers sat shivering with terror at a distance. All the evening crowds of people came trooping down from the mountain to stare at my camp and swell the ill-omened crowd gathered round it. At last, with a troop of some sixty at his heels, came Shaykh Hamo, the religious chief of that region. He was of more cheerful aspect than the others, and helped to dispel the feeling of depression and helplessness that had gradually crept

over one in the course of the day. He came into my tent, and I entertained him to the best of my ability. He said that if war broke out between Persia and Turkey, the men of Sinjar would kill every Moslem within reach, a sentiment loudly applauded by the rest; indeed, the solitary yapping cry by which they marked their approbation of their pastor's speech

YEZIDI OF SIKENIYEH.

was the first sign of animation I noticed among them all that day. Shaykh Hamo then took his leave, and after his departure a good many of the others stole away towards the hills. After sunset, my host, Khalil Agha, sent down six men to look after my camp, and their repeated and earnest inquiries as to what time I usually went to sleep did nothing towards restoring my confidence. However, beyond a few stray shots fired at a distance, nothing of import occurred during the night, and the next morning we set off for the town of Sinjar.

"When the Turkish flag, which flies from the top of the hill on which the town is situated, came in sight, my muleteers began to sing for the first time since the preceding day."

At Tel Afar we find an interesting survival in the small Turkish settlement which still remains there. These Turks, who must have settled at Tel Afar early in the twelfth century, apparently lost all connection with the other invaders, and seem to have remained independent until the days of the reforms of Sultan Mahmud. At that time they were a thriving predatory independent community. According to themselves, their history is as follows: They are escaped slaves and runagates who settled in the ruins of the ancient city of Tel Afar. They formerly lived independently in a kind of commune, and, under an elected leader, held their own against the Shammar, even when the latter levied toll on Mosul. The great strength of the men of Tel Afar lay in the large and solidly built castle, the ruins of which now cover the hill overlooking the town. However, in the days of Reshid Pasha the Turks refused to admit the rights of the Constantinople Government, which reappeared, for the first time since the days of Heraklius, in those parts early in the thirties of the nineteenth century; consequently, the independent *régime* was brought to an end and the castle laid in ruins by a military expedition.

I have, I think, now given you a rough idea of the present appearance and condition of the Northern Jazirah, for once Tel Afar is left behind we enter into the sphere of influence of Irak, which is as different a country to the Jazirah as is Castille to Normandy. Had I been reading this paper ten years ago I should have terminated here, but I feel that a question has now arisen which cannot be passed by, and that is the Bagdad railway. I will not enter into the political aspects of the case, but will try and give my unbiased opinion as to the prospects of the German venture should it once set foot in the Jazirah. In the first place, I will take in detail the difficulties with which it is expected to have to contend.

Firstly, the constant tribal warfare. Now, I have endeavoured to show how trifling an obstacle this is. At present the tribal warfare goes on because there is nothing to stop it, but, nevertheless, caravans pass to and fro from Aleppo to Mosul without being inconvenienced by it as long as they have a single soldier with them—a posse of ten soldiers can usually turn back the most ferocious war-party—and the aghnam, or sheep-tax, is collected from warlike tribes without any great difficulty; consequently we need not expect that a railway would be much inconvenienced by it. Organized opposition is impossible; the difficulties which a man like Ibrahim Pasha experiences, even with Government assistance, in keeping his tribes loyal to himself are sufficient to show how fruitless it would be for any other tribe to endeavour to prevent the railway being built.*

Secondly, the difficulty of developing a land without a sufficient

* Ibrahim himself and nearly all his allies are eager for the railway to be built. The only inhabitants of the Jazirah who are against the scheme are the Shammar of the south.

population. Here indeed is an objection which would seem more formidable; however, I am convinced it is not so terrible as might at first be supposed. I have described to you how rapidly villages have grown in the district of Seruj; I will draw your attention to an even more striking case. Any one riding over the road between Aleppo and Meskene some ten years ago would have found what was tantamount to a desert—a few ruins, some scattered encampments, and half a dozen villages would have been all that would have met his eye. Now this year I passed over that tract in March and again in October. In March I never left cultivated land until I was within three hours'

BELAD SINJAR.

ride of the Euphrates; in October I found that distance had decreased by a third; now that tract of country has been settled and cultivated by the poorer nomads who formerly lived there, by Kurds of the Berazieh and Dinardieh who had been crowded out of the Seruj district, and by Arabs from the coast and Turks from the mountains of the Taurus The Arabs, Kurds, and Turks were rapidly amalgamating into one race of which Arabic was the language. The problem of settlement of the desert between Aleppo and the Euphrates had been solved by natural forces; the increasing size and prosperity of Aleppo had made it necessary for the Government to bring the Bedawin under control. The moment they were checked, the poorer nomads began to cultivate, and

were immediately joined by the floating populations of Kurds and Turks. A moderate infusion of the two latter stocks in the population works wonders on the Arabs, who lose their dirty, penurious, and feckless habits, while the Kurds and Turks, by intermarriage with Arabs, grow more civilized and intelligent. Now, in the Jazirah we have already the nucleus of an agricultural population along the banks of the Belikh and Khabur in the tribes of fellahin Arabs; once they are secure from raids and have a market for their produce, they will begin to work in earnest, and they will instantly be assisted by the Kurdish immigrants who are at present earning but a very precarious existence as agriculturists among the mountains north of Urfa. We have also to count upon reinforcements from Deir Zor. Fifteen years ago Deir Zor was a small transit town, probably little more than a village; it has now, roughly, 25,000 inhabitants, mostly Kurds: of these, at least 6000 would be available for agricultural purposes. Another point I should like to make is that there are about 14,000 of the Milli and Kikieh Kurds on the slopes of the Karaja Dagh, who have every intention of settling along the banks of the Jag Jag and upper reaches of the Khabur whenever the railway comes. On this point I had the following statement from the chief Agha of the Kikieh Kurds—he was at the time encamped on the banks of the Jag Jag: "Formerly we Kikieh lived here in villages in winter and tents in summer, but the Shammar destroyed our crops and drove us up to the Karaja Dagh, where we live in houses in winter. However, we come here to pasture our flocks in spring, and also to show we have a right over the land. When the railway comes we shall be very rich. I shall bring all my people down here; the Government will be forced to protect them; and we may build, perhaps, five hundred villages." And this is only one tribe among many. In the Sinjar we have a district already well cultivated, and inhabited by about 30,000 industrious people, most of whom are completely sedentary. We may also count on many of the native labourers who come to build the railway settling along it.

I think these few points tend to show that once there is rapid and commodious transit, the questions of labour and security will not present such difficulties as people might suppose. Against this, however, we must remember that the idea of European colonization is hardly one that can be entertained. On several occasions large colonies of Circassians have been introduced by the Government, and although they were good farmers, and could hold their own with ease against the Arabs, they always succumbed to the climate; in fact, the Jazirah is not a country for white men to work in. The climate in summer is terribly trying, and the autumnal Malarial fevers are extremely dangerous. Europeans, even when not leading a sedentary life, get run down and slack, and if a man is to be a pioneer agriculturalist, he cannot afford to be either.

Before closing this paper, there is one more thing to which I should like to draw attention, and that is the proposed trace of the railway. I am inclined to suggest that, after reaching Ras-el-ain, the line should then follow the Khabur on the left bank as far south as Shedadeh, and then skirt the foot of the Sinjar hills as far as Tell Afar, and afterwards resume the old proposed trace along the Tigris. My reasons for making this suggestion are as follows: (1) Once the Khabur is reached, the actual expenses of laying the line would be but slight, the physical obstacles being trifling—how slight, indeed, may be judged from the fact that in the days of the early khalifs there was a canal connecting the Wadi Serser with the Khabur, running from Tel Kokab to the southern slopes of the Sinjar; (2) that it would develop the interior waters of the Jazirah first. That the settlement of the banks of Khabur and Jaggag rivers should come first is, I submit, of primal importance. Agriculture between Baghdad and Mosul, although not very flourishing, is well under way; between Nisibin and Mosul the land is to a certain extent populated. Now, should the railway take the northern side of the Sinjar, all tendencies will be to migrate and settle northward and eastward; a branch line from Mardin to Deir would probably be under discussion for many years before it was accomplished, and during all that time the magnificent lands on the banks of the Khabur, Belikh, and Jag Jag would be lying idle. If, on the other hand, the trace I have suggested be followed, the whole trend of agricultural immigration and settlement would be diverted to its proper central channels and led away from the stony ridges of the Mardin hills, whither it has been driven by Arab incursion. Thus, if the central line is followed, we may expect with confidence to see a chain of villages and fields some 100 miles in length, where at present there are not above twenty permanent dwellings; Deir Zor would still remain a central depôt for grain as far south as Ana, and it would be connected with Shedadeh by plenty of cheap wheeled traffic.

As regards the repopulation of the tract between Ras-el-ain and Shedadeh, this would not prove so difficult as many people imagine. In the last three years 56 new villages have sprung up between Mahdum and Jubb es Sofa near Aleppo; these villages have been sufficient to set the area in which they have been built under general cultivation. Taking that district as a basis of calculation, I find that about 312 villages would have to be established along the central rivers between Shedadeh and Ras-el-Ain, a number which, according to all local authorities such as shaykhs, zaptiehs, mollahs, and so forth, could be easily provided twice over by the Baggara, Weldi, Aghedaat, Kiki, and Dinar Kurds, and Arabs, without counting the influx of people from Aleppo, Mardin, and Mosul. Once a small settled population had been established in security along the central rivers, no one acquainted with the country would doubt as to its rapid increase.

Before the paper, the PRESIDENT: I have to introduce the lecturer, Mr. Mark Sykes, but I expect that many of you already know him from his books, the first of which appeared, I think, in 1900. It was a short but interesting account, by a young traveller, of Asiatic Turkey. In 1904, after further journeys in those regions, he produced a more ambitious book full of information and with excellent maps, under the title of 'Dar el Islam.' Since then Mr. Sykes has been travelling again between the Tigris and the Euphrates, one of the most interesting regions of the world, and he will give us to-night the benefit of his further investigations. I may say that Mr. Sykes has been studying the Near East from his boyhood. I believe he was first taken into the Hauran by his father, when he was only ten years old; and, incidentally, I may mention that Sir Tatton Sykes is now celebrating his eighty-first birthday in Yokohama. In Mr. Mark Sykes we have the advantage of listening to one who has made a careful study of the various races of that part of the world, and especially of the Kurds, a most interesting people. I now invite him to read his paper.

Sir HENRY TROTTER: In the absence of more competent speakers, I shall be very happy to say a few words; but am afraid I shall have to deal with ancient history, as it is from twenty-five to thirty years ago that I lived in those parts. During the last Turko-Russian war I was attached to the Turkish army in Asia Minor, and we had a large contingent of Kurds from all parts of the country. I had a great deal to do with both Kurds and Arabs at times, and I became very friendly with some of the Kurdish chiefs. I was very glad to hear the few words said in favour of the Kurds to-night, because they generally get more kicks than halfpence. I was specially sympathetic because they were fighting for their country. They did so a little after the manner of the Arabs, and did not care much for close quarters. These Kurds are very striking fellows, and reminded me very much—especially the tribal Kurds—of the old Scottish clans. They are very feudal in their nature, and reverence their chiefs in the same way as the old Highlanders reverenced the head of their clan. In some respects they had the advantage of the Highlanders. The latter, when they went on raiding expeditions, always went on foot, whereas the Kurds travel on horseback. Some of the young chiefs were fine, handsome-looking fellows, but it is very curious how in old age they change; a young fellow of about eighteen or twenty will develop into a man very much like that picture we saw of Ibrahim Pasha, who is a typical chief. A rather curious incident occurred in connection with one of the friends I made there. Two years later I was going from Erzeroum to Diarbekir, and I was anxious to get there before winter. By going straight across the mountains I could arrive in nine days, whereas it took twenty-two days to go by the ordinary caravan road. I pressed the governor to give me an escort to send me across the mountains; he refused at first, but after a good deal of pertinacity on my part, he sent to the prison and took out the principal robber and introduced us, saying, "You see this gentleman safe over, and you won't go back to prison." Needless to say, I had an exciting journey, but arrived safely, and the Kurd never went back to prison. On the way I visited a Kurdish chief whose name had been prominent in some of my own reports as one of the worst oppressors of the Christians, and I had made up my mind to give this fellow a lecture. I sent word to announce my visit, and prepared a long discourse on the enormity of his ways, but on being shown into the audience chamber, we looked at each other for a moment and then rushed into each other's arms. He was one of my old Kurdish friends. Needless to say, I did not deliver the lecture as I had intended. We had a friendly talk, and I believe the result was that he did mend his ways, at any rate for a time. While at Diarbekir I visited Dara, an old Roman frontier town full of most interesting remains. It was there, I

recollect, that I first took an interest in numismatics. The Arab boys brought handfuls of copper coins. I looked at them afterwards, and I found there were better coins to be got elsewhere, and from that date I became an inveterate coin-collector. The coins of that part of the world are especially interesting. After the break up of the Khaliphate, of which the lecturer spoke, a number of princes struck coins of their own, and at the time of the Crusades these princes struck them in order to carry on commercial intercourse with the Crusaders, specially interesting as having copies of Byzantine, Roman, or Greek coins on the one side, and old Arabic inscriptions on the obverse.

Another interesting spot in Mesopotamia was the village of Tell-ermen—an Armenian colony in the great plain south of Mardin—which I believe was subsequently destroyed at the time of the Armenian massacres. At the admirably kept village school, one was much struck with the great number of languages in use in this part of the country. The instructors were highly educated Catholic Armenians, and the little children were thoroughly at home in the French, Arabic, Armenian, and Syriac languages.

General James: Will you allow me to say a few words? In the years 1857 and 1858 I was attaché to the International Boundary Commission between Turkey and Russia in Asia Minor; we visited Kars, Erzerum, Bayazid, and Erivan, and lived for a good many months in both these years in the district of the Mount Ararat range. As we were there on Government service, with a very strong escort of Turkish dragoons on one side and Cossacks on the other, the nomadic tribes were very civil to us. We lived for several weeks near the Yezidi Kurds, and I suppose they were on their good behaviour as we had such a strong escort. We lived amongst them, and often dined in their tents. There was one thing they would not allow us to do, and that was to take any part in their religious ceremonies, which were supposed to be rather mysterious. They were very good fellows, and occasionally gave us roast kids for dinner; we enjoyed our sojourn amongst them very much. Instead of their appearing such arrant scoundrels as they have been represented to-night, they treated us with uncommon civility.

Miss Lowthian Bell: I should rather like to know from Mr. Mark Sykes whether this route he has suggested for the Bagdad railway has been surveyed. All that country was surveyed by Baron Oppenheim. He found some extraordinarily interesting Hittite remains in the Jebel Abdul Aziz. And he certainly went to Jebel Sinjar, of which he gave me a very blood-curdling description. He must have seen that country pretty accurately; he was sent out for the principal purpose of surveying the country for the emperor, and therefore I suppose they considered the northern route easiest. I do not believe the exact route is settled. We have this line of ancient towns on the northern route, and apparently a thickly populated district, and I suppose it is still populated. I suppose that was the reason they selected that route. One other suggestion I should like to make, and that is with regard to the pictures of the mosque at Diabekir. I hope Mr. Mark Sykes, in the interest of archæology, will have both the photographs made into slides and give them to the Hellenic Society, for they would greatly appreciate them. The mosque, I believe, is an Hellenistic ruin. I do not think the photographs he showed this evening have been published; they look very much of the same character as the well-known façade at Urfa, and therefore I suppose they are of the same date.

The President: In proposing a vote of thanks to Mr. Sykes, I shall not interpose any remarks of my own, as I see that he is anxious to reply to the questions put to him. I ask you to join in a hearty vote of thanks to him for his excellent paper, admirably delivered. Before we separate, I must say one word. Miss Lowthian Bell has paid a very just tribute to the Society. We are

always very glad to obtain papers from ladies, and we are most anxious that they should join with us in every possible way in extending geographical knowledge. We are glad to benefit not only from their experiences in exploration, but also from their ideas on geographical science. In these modern days there is no question of excluding either their knowledge or their intelligence.

Mr. MARK SYKES: I thank you very much for the vote of thanks, and I will immediately take the various posers that have been put to me in detail. As regards the Yezidis, I was compressing my lecture as much as possible, and consequently I did not say that between Sinjar and Mosul I spent one evening with the Yezidis tribe, who were extremely kind to me. They gave me food, and entertained me very well indeed, and I was very grateful to them. At the same time, I might add that their headmen were in prison at Sinjar, and they had had an awful hiding about a fortnight before. As regards the northern route, of course, it may be—I do not say it is so—but it may be very advantageous when it is a matter of kilometrical guarantee in having a longer route. I submit that when you get so much per kilometre, it is sometimes an advantage to make your line a little longer than it need be. My idea is that the southerly course would not only be shorter, but also central; going from Rasel Ain to the end of the Sinjar, you get fairly near to the Belikh on your right, and on the left-hand side you have several rivers. You have easy lateral communications, as all that desert is open to wheel traffic, and my idea is you run your railway through the centre of the corn-growing country, and have the corn and grain and produce brought in from short distances on either side. I think that would be economic. If the railway goes northwards to Nisibin, I would say that the Kharbur valley, with all its possibilities, would lie derelict for years to come.

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND.*

Under the Direction of Sir JOHN MURRAY, K.C.B., F.R.S., D.Sc., etc., and LAURENCE PULLAR, F.R.S.E.

PART XIII.—LOCHS OF THE NESS BASIN.

SECOND PART.

THE first part of this paper, published in the July issue, dealt with the physical features of Loch Ness, and in this second part it is proposed to describe twenty-seven of the tributary lochs. The remaining five lochs will be treated of in a third part, which will also include some general notes on the temperatures and seiches observed in Loch Ness, on the deposits covering the floor of Loch Ness with chemical analyses of some selected samples, on the biology of the lochs within the Ness basin, and on the geology of the district, as well as a summary table giving particulars of all the lochs in the basin which were surveyed.

* Maps, p. 468. The admirable maps which accompany the three parts of the Ness paper (the last of the series) have been presented by Sir John Murray and Mr. Laurence Pullar, and it is thus due to their liberality that we are able to publish them free of any cost to the Society.—PRESIDENT R.G.S.

The relative position of the various lochs is shown in the little index map of the Ness basin (Fig. 1). Lochs nam Breac Dearga, Dubh, Laide, Tarff, Knockie, nan Lann, and Kemp, described in this paper, are shown on the Loch Ness maps (Plates I. and II.) issued with the July *Journal*.

Loch Quoich (see Plate III.).—The largest loch in the basin after Loch Ness. It is very nearly 7 miles in length, and occupies the upper part of Glen Garry, which here runs east and west. It is 9 miles west

FIG. 1.—INDEX MAP OF THE NESS BASIN.

of Loch Garry, and 15 miles from Loch Oich. It is much nearer the west coast, the head of Loch Hourn being only 4 miles distant. The mountain peaks both north and south reach well over 3000 feet. On the south the highest peak is Sgor Mor (3290 feet). On the north the two peaks of Sgurr a' Mhoraire (3365 feet) and Gleourach (3395 feet) rise to the west and east of Glen Quoich, which branches northward from Glen Garry about the middle of Loch Quoich. On the north Loch Quoich is densely wooded for the greater part of its length.

Loch Quoich is of the usual elongate form of Scottish glen lochs.

Its central line is strongly curved, the central part further north than the ends. The height of the loch above sea-level on May 6, 1903, was 556·0 feet; the Ordnance Survey officers, on August 24, 1867, found it to be 555·3 feet. The length, measured in a straight line between the ends, is almost exactly 6 miles; measured along the centre line it is nearly 7 miles. The maximum breadth of three-quarters of a mile occurs just east of the centre. The mean breadth is a little under half a mile. The superficial area of the loch is about 1833 acres, or fully $2\frac{3}{4}$ square miles, and it contains 8345 millions of cubic feet of water, more than twice the volume of Loch Garry, the loch next to it in size.

Loch Quoich drains an area of 49 square miles, which includes no large lochs, but some very small ones which were not surveyed. Several large burns, rising among the high mountains of the west, enter at the head of the loch, and the Caolie Water, flowing in on the north shore, is a fair stream; but the most important inflowing river is the Quoich, which enters about the middle of the north side, and has here by its delta effected a considerable narrowing of the loch. The constriction so produced is the greater because, just opposite the mouth of the river, a high promontory juts out more than a quarter of a mile from the south shore. The shallowing of this constriction is but slight.

The basin of Loch Quoich is simple, with steep and nearly uniformly sloping sides, and very little flat bottom. The contours are all continuous and approximately parallel with the shore-line, except the 200-feet contour, which is slightly interrupted by a shallowing where the maximum is 190 feet, just west of the mouth of the Quoich. The area of over 200 feet to the west of this is three-quarters of a mile long, and has a maximum depth of 220 feet. The larger area of over 200 feet is 2 miles long, and extends from just west of the narrows eastward. The area of over 250 feet lies well down the loch, coming to within $1\frac{1}{2}$ miles of the outflow, and includes the maximum depth of the loch, 281 feet. The mean depth of the loch is $104\frac{1}{2}$ feet. The proper basin of the loch terminates three-quarters of a mile from the lower end of the loch. At this point there is a bend at right angles to the main axis, and there extends a broad, tortuous, shallow section of the loch, with a greatest depth of only 43 feet, and numerous small islands.

As is shown by the narrowness of the areas enclosed by the deeper contours, there is no marked indication of the U-shaped section of valley lochs excavated by glaciers. The promontory opposite the river Quoich, occurring where a great bend of the axis takes place, must have caused a narrowing here before the delta of the Quoich was laid down.

On May 6, 1903, the difference of temperature between the surface and 150 feet was under 1°:—Surface, 41°·9 Fahr.; 50 feet, 41°·2; 150 feet, 41°·0.

Loch Poulary (see Plate IV.).—A long, irregular, narrow loch running east and west in Glen Garry, between Loch Garry and Loch Quoich, about 4 miles distant from the former and 2 miles from the latter. It is little more than a series of expansions of the river Garry, and its limits are accordingly not easy to define. The portion surveyed begins at Eilean Dubh, extends eastward for 1 mile as a narrow channel varying from 9 feet to 23 feet in depth, and then expands into a little basin half a mile long by one-fifth of a mile in greatest breadth. The length of the whole loch is 1½ miles, and the mean breadth one-tenth of a mile. The area of the surface is about 91 acres, and the drainage area, which includes Loch Quoich, is 82 square miles. The volume of water is 39 millions of cubic feet. The Allt a' Ghobhain, a considerable stream, and some small burns, enter on the north shore. From spot-levels on the shores, the height of the loch above the sea was estimated to be 320 feet. The greater part of the loch is shallow, but in the eastern basin there is deeper water in the centre, forming, however, only a narrow channel. The maximum depth is 47 feet, the mean depth 10 feet.

There was a difference of only 1° in temperature between the surface (53°·8 Fahr.) and a depth of 40 feet (52°·8) on September 28, 1903.

Loch Garry (see Plate V.).—Loch Garry is one of the most important lochs in the basin, being inferior in size only to Loch Ness and Loch Quoich. It occupies the lower part of Glen Garry, and its lower end is only about 3 miles west of Invergarry on Loch Oich; its direction is about due east and west. Glen Garry is at this part very open, the high hills, Ben Tee, a conspicuous pyramidal hill 2936 feet in height, on the south, and Meall Dubh (2581 feet) and some lesser peaks on the north, being several miles distant. The sides of the valley rise gradually to the mountains, the lower slopes on both shores of the loch being densely wooded.

Loch Garry is elongate, slightly curved, of nearly uniform breadth for the greater part of its length, but in the eastern part for a mile very irregular and shallow. Its length is 5 miles, its greatest breadth fully half a mile, and its mean breadth one-third of a mile. Its superficial area is about 1117 acres, or 1¾ square miles, and its contents 3794 millions of cubic feet. The drainage area, including Lochs Quoich and Poulary, is 137 square miles. Besides the river Garry, which enters the loch at the west end, some large streams, coming down from the mountain-mass to the westward of Ben Tee, enter on the south, and many smaller streams on the north. Leaving the loch, the river Garry flows 3 miles to the east and enters Loch Oich at Invergarry.

Loch Garry, at the date of the survey (May 2, 1903), was 257·0 feet above sea-level; the Ordnance Survey officers on July 2, 1869, found the elevation to be 257·8 feet above the sea.

In the character of its basin Loch Garry closely resembles Loch Quoich, higher up in the same glen. The main part of the loch, fully 3¼ miles long, is a simple basin. As in Loch Quoich, there is a large portion at the east end, one mile in length, which is quite distinct from the basin, and is of moderate depth.

This eastern part is cut off from the main loch by a large, low, wooded promontory, called the Garbh Eilean (Rough island), and a sandy island (Eilean Bàn), to the south-west of it. An irregular channel, varying from 9 feet to 18 feet in depth, leads to the small eastern basin, which has a small island at each end, and a narrow arm running to the north. This basin has a narrow area half a mile long, over 25 feet in depth, with a maximum depth of 43 feet. At the west end of Loch Garry a narrow offset runs for half a mile westward, with a depth of 5 feet at the mouth, and of 8 to 16 feet within.

The main basin shallows greatly towards each end. The 50-feet and 100-feet contours closely follow the shore, except at the ends. The 150-feet contour encloses but a narrow area 1¾ miles long. This is a good deal nearer the south shore in the greater part of its length, but for half a mile at its west end it recedes far from the south shore, where the slope from 100 to 150 feet is very gradual. A small isolated 150-feet area, based on a sounding in 159 feet, lies to the east of the main 150-feet basin, the deepest sounding in the short interval between them being 146 feet.

Centrally, in the length of the loch, but nearer the south shore, is a small area a quarter of a mile long, over 200 feet deep, with the maximum sounding of 213 feet. The mean depth is 78 feet. The contours show that the slope of the bottom is nowhere very steep, but is steepest on the south side at the deepest part of the loch. There is but little extent of flat bottom at depths of over 150 feet, but where the depth is less than that, especially towards the west end, there is a well-marked flat with steeper sides.

The temperature at the surface was 42°·4 Fahr., and at 170 feet 41°·8, a difference of only 0°·6.

Loch a' Bhainne (see Plate VI.).—A very little loch, high up on the hill to the north of Loch Garry, about 2 miles north of the east end of that loch. It is roughly triangular, with the apex to the south. The hills rise steeply from the loch to the west and north. It is fed by streams coming from Màm a' Chroisg, and the Allt a' Bhainne flows south-eastward 3 miles into the river Garry. The bottom is irregular, the greater part covered by less than 10 feet of water, but there are two holes of over 20 feet, the larger with the maximum of 28 feet close to the east shore, the other with a depth of 27 feet to the south; a sounding of 13 feet between the two.

It is one-third of a mile long, a quarter of a mile in greatest breadth,

and one-seventh of a mile in mean breadth. The mean depth is 10 feet. The superficial area is about 32 acres, and the volume 14 millions of cubic feet. The drainage area is nearly 2 square miles. The height above sea-level was estimated at 1060 feet. The temperature at the surface and at 20 feet was 45°·0 Fahr. on May 5, 1903.

Loch Lundie (by Garry) (see Plate VI.).—A small loch in Glen Garry, on a tributary of the river Garry, about 1½ miles north-west of Invergarry, on Loch Oich. It is of irregular form, its outline broken by various arms and promontories. A point on the west side, with an island off the east shore (Eilean na Faoileige), cause a narrowing and separate two expansions. From the northern expansion several narrow arms run north-eastward. Loch Lundie is three-quarters of a mile long, by fully one-third of a mile in maximum breadth, with a mean breadth of one-fifth of a mile. The surface has an area of about 109 acres, and the volume of water is 78 millions of cubic feet. The drainage area is about 3½ square miles. The Allt Lundie comes in on the west, and the Aldernaig Burn, soon joined by the Allt a' Bhainne from Loch a' Bhainne, flows south into the river Garry. The height above sea-level, measured by the Ordnance Survey on August 18, 1869, was 445·4 feet.

The contour of the bottom is very uneven. The 20-feet contour enters both expansions, keeping closer to the west shore. In both of the expansions there is a depth of 30 feet close to the west side. The deepest water in the loch is close off the promontory on the west shore and nearly in the narrows. Here is a little area over 40 feet deep, with the maximum of 54 feet. Rock was seen at a number of points on the east and south. There are several small islands, and one of these, north of Eilean na Faoileige, is of rock.

The temperature on May 5, 1903, was almost uniform throughout—at the surface, 46°·5 Fahr.; at 40 feet, 46°·5 Fahr.; and at 50 feet, 46°·6 Fahr.

Loch Oich (see Plate VII.).—An insignificant loch in point of size, though of considerable length, Loch Oich is commercially important, as it forms the highest portion of the Caledonian Canal. As regards length, it comes fifth in the Ness basin, if we exclude the artificial Loch Mhor.

Loch Oich is an exceedingly narrow, straight loch, with its long axis running nearly south-west and north-east. High hills rise on the east, and the dense woods which clothe the west shore, with the islands on its surface, render Loch Oich extremely beautiful (see Fig. 2).

Loch Oich is 4 miles long, and has a maximum breadth of little over a quarter of a mile, and a mean breadth of barely one-fifth of a mile. The superficial area is about 489 acres, or three-quarters of a square mile, and the contents amount to 890 million cubic feet of water.

This is about one-half the volume of Loch Clunie, a loch very little longer, and only one-fourth the volume of Loch Garry.

The drainage area of Loch Oich, including as it does Lochs Quoich and Garry, is very large, amounting to 170 square miles. The drainage is brought chiefly by the river Garry, which enters the loch about the middle of the west shore. Only little hill-torrents come in on the east. The out-flowing river Oich runs 4 miles north-east to Loch Ness. The level of the loch on May 1, 1903, was found to be 106·0 feet above sea-level; on the Ordnance Survey map the level is given as 104·8 feet above the sea, but the date on which the observation was made is not indicated.

FIG. 2.—LOCH OICH, LOOKING SOUTH-WEST; CALDER BURN IN THE FOREGROUND.
(Photograph by Mr. G. West. From 'Proc. Roy. Soc. Edin.,' by permission of the Council.)

The outline of Loch Oich is constricted at several points, first at Ardrishaig, half a mile from the south end, again a mile further down the loch, and again at the mouth of the Garry, where a great peninsula has been made by the river, and opposite to it long narrow islands. From the mouth of the Garry the width increases to near the overflow. A great part of the loch, equal to 68 per cent. of the entire area, is less than 50 feet in depth. The central part of the loch is shallowest. Opposite the mouth of the Garry the greatest depth is 20 feet, close to the island. There are four areas of over 50 feet. The first of these is close to the north-east end of the loch. It is three-quarters of a mile long, and encloses an area half a mile long over 100 feet in depth. Near

the south-west end of this 100-feet area is the maximum depth of the loch, 154 feet, and near the other end of the area there is a sounding of 129 feet, with a depth of only 108 feet between them. The second 50-feet area is half a mile south-west of the river Garry, and is marked by an isolated sounding of 57 feet. The third 50-feet area begins half a mile from the south-west end, and extends down the loch for a mile. It is the largest basin in the loch, but not so deep as the more northerly one, the greatest depth in it being 133 feet. The fourth 50-feet area is close to the upper end of the loch. It is one-third of a mile long, and is scarcely separated from the larger one, as they are close together, and the depth between is 48 feet. In this fourth basin the greatest depth is 84 feet. The following serial temperatures were taken in the deepest part of the loch, series I. on May 1, 1903, and series II. on September 25, 1903:—

	I.	II.
Surface	44°·9	55°·0 Fahr.
10 feet	44°·9	54°·0 "
20 "	44°·8	54°·0 "
30 "	—	54°·0 "
40 "	44°·2	53°·8 "
50 "	—	53°·8 "
60 "	—	53°·8 "
70 "	—	53°·8 "
80 "	43°·9	53°·0 "
90 "	—	51°·9 "
100 "	—	49°·8 "
120 "	—	48°·8 "
130 "	43°·0	— "

The series taken in May shows a range of barely 2° from surface to bottom, while the series taken in September shows a range of over 6°, a fall of 2° having been recorded between 90 and 100 feet. It will be observed that the whole body of water was warmer in September than it was in the preceding May, the bottom reading in September being 4° higher than the surface reading in May, while the difference between the two bottom readings is about 6°, and between the two surface readings about 10°.

Loch Uanagan (see Plate VIII.).—Loch Uanagan lies a little more than a mile to the south of Fort Augustus, on Loch Ness. It is a narrow little loch lying parallel to the Caledonian canal, which is one-third of a mile to the west, and is separated from Loch Uanagan by the Torr à Choiltry, a high ridge with steep sides, densely covered with fir trees. This hill rises abruptly from the west side of the loch to a height of 384 feet, some 266 feet above the surface of the water.

Loch Uanagan is half a mile long, and has a maximum breadth of one-eighth of a mile. The superficial area is about 25 acres, and the volume of water 18 millions of cubic feet. The drainage area is about

1½ square miles. The only stream of any size flows in at the south end, and near the north end a small burn flows out to the east, where a small part of the loch has been cut off by the railway, and joins the river Tarf half a mile to the north. The height of the loch above sea-level on July 2, 1903, was 115·2 feet.

Loch Uanagan is very shallow, the greater part of it less than 10 feet deep. Only one-fifth of the area is over 25 feet in depth, the 25-feet contour enclosing a narrow area one-sixth of a mile long, nearer to the east shore, and the maximum depth of 43 feet is near shore, the slope here being steep. The steep slope of the hill on the west is not continued under water, the loch on that side being shallower.

The surface temperature on July 2, 1903, was 63°·0 Fahr., and a serial taken at 2.30 p.m. on September 24, 1903, gave the following results:—

Surface	55°·4 Fahr.
10 feet	54°·8 „
20 „	53°·6 „
30 „	53°·6 „
40 „	52°·8 „

Loch Beag (by Clunie) (see Plate IX.).—A small triangular loch about a quarter of a mile west of the upper end of Loch Clunie. It is simply an expansion of the river Clunie, and is at the same level as Loch Clunie. It is one-third of a mile long by one-fifth of a mile broad. The area of the surface is about 26 acres, and the drainage-area very extensive, viz. 20 square miles. The volume of water is 13 millions of cubic feet. The basin of Loch Beag is simple, the sides gently sloping, the greatest depth, 29 feet, in the centre of the loch. The channel connecting Loch Beag with Loch Clunie varies in depth from 11 feet to 23 feet.

Loch Clunie (see Plate IX.).—Loch Clunie (or Cluanie) is a large loch occupying Glen Clunie, which runs east and west, and is the source of the river Moriston. The lower end is about 16 miles distant from Invermoriston, on Loch Ness. The upper end is some 13 miles from Sheil bridge, at the head of Loch Duich, on the west coast, but Loch Hourn is still nearer, only 10 miles as the crow flies. High mountains rise on both sides of the loch, those on the south reaching nearly 2500 feet, while on the north the highest peak, Sgurr nan Conbhairean, 2 miles distant, is 3632 feet in height.

Loch Clunie is very narrow, 4¼ miles in length, and its central line has a slight sigmoid curvature. The shore-line is very irregular, and the width varies greatly at different parts. Widest in the upper part, where the maximum breadth of half a mile occurs at two points, at the extreme west end, and 1¼ miles further east, whence the loch narrows

greatly toward the east, till about a mile above the outflow the width is only one-fifteenth of a mile. Beyond this narrow part it expands into a distinct small basin nearly a quarter of a mile in breadth. The mean breadth of the entire loch is just about a quarter of a mile. The superficial area exceeds 1 square mile (about 704 acres), and the drainage area, which includes no other lochs except Lochs Beag and Lundie, is 32 square miles. It is fed by the river Clunie and some large burns on the north shore, very little water entering on the south shore, except the surface drainage. The river Moriston flows out from the east end of the loch. Considering the volume of water, which amounts to 1533 millions of cubic feet, Loch Clunie comes fourth in point of size in the Ness basin (including Loch Ness). In point of length it comes fifth, as Loch Mhor is about half a mile longer, though in volume about 400 million cubic feet less, than Loch Clunie.

The level of Loch Clunie on September 29, 1903, was 605·2 feet above the sea; the Ordnance Survey officers on October 5, 1867, found the level to be 605·9 feet. The water might rise 4 feet above the level on the date of the survey. Above the narrows, 1 mile from the east end of the loch, which cut off a small basin exceeding 50 feet in depth, the basin of Loch Clunie is a simple one. The 25-feet contour closely follows the shore-line, and the 50-feet contour is nearly parallel to it, but much closer on the north, where the slope is steeper. The 100-feet contour is parallel with the others, and encloses a relatively large area, nearly 1½ miles long by a quarter of a mile in greatest breadth. It is broken into two parts by an unimportant shallowing of 98 feet. The smaller western portion has a maximum depth of 119 feet; the greater area has a maximum of 123 feet. The mean depth is 50 feet. In the narrows the depth at the western end is 10 feet, and at the eastern end only 6 feet, while halfway between is a hole of 23 feet. The small basin to the east of the narrows is on the whole shallow. Almost in the centre is a shoal where the depth is only 2 feet, and close to this, on the north, is a sounding of 30 feet. The greatest depth in this basin, 53 feet, is between the shoal and the narrows.

Consideration of the contours and the nearly flat bottom shows that there is the U-shaped section associated with glacier-hollowed lochs, though, on account of the moderate depth, it is less clearly defined than in many other large lakes.

A series of temperatures taken in the deep part of the loch showed a uniform reading of 51°·8 Fahr. at all depths from 10 feet to 75 feet. The bottom at 100 feet was a little cooler (51°·2), and the surface a little warmer (52°·0), the total range being thus 0°·8.

Loch Lundie (by Clunie) (see Plate IX.).—A small triangular loch lying immediately to the north of Loch Clunie, about equally distant from either end. The long axis runs nearly east and west, and the

greatest breadth is towards the west end. The outline is very irregular, and there are several small islands near the shore.

The height above sea-level on September 30, 1903, was found to be 681·5 feet, some 76 feet above Loch Clunie; the Ordnance Survey officers on August 2, 1869, found it to be 681·9 feet. The length is little under half a mile, and the greatest breadth one-fifth of a mile. The superficial area is about 27 acres, the drainage area nearly 1 square mile, and the contents amount to 9 millions of cubic feet. It receives only some small burns, and is drained by a burn issuing from the south-west corner flowing south a quarter of a mile into Loch Clunie.

Loch Lundie is of no great depth, three-fourths of the superficial area being covered by less than 10 feet of water. The area more than 10 feet in depth is narrow, and passes obliquely across the loch. The greatest depth of 25 feet occurs at the extreme east end of this area, and near shore, in a narrow part of the loch.

The temperature on September 30, 1903, was the same at the surface and at 20 feet, viz. 54°·0 Fahr.

Loch Loyne (see Plate X.).—The two lochs under this name consist of a chain of little basins or expansions of the river Loyne, connected by narrow channels. The valley of the Loyne lies halfway between Glen Clunie and Glen Garry, which are 2 or 3 miles distant. On the north the lochs are separated from Loch Clunie by Beinn Loinne, 2500 feet in height. The hills on the south, though wild and bleak, are not so high. The main road from Tomdoun to Clunie Inns crosses between the two lochs. The valley to the west of the road has an east-and-west trend, but from the bridge through the east loch to Glen Moriston it runs nearly due north-east. The east loch is much the longer, and is also deeper.

The West Loch.—The west loch lies at a height of 719·0 feet above the sea. It is $1\frac{1}{4}$ miles in length, with a maximum breadth of fully one-third of a mile, and a mean breadth of one-fifth of a mile. It consists of three expansions, all running south from the connecting channel, or, in other words, the north shore is unbroken, but two promontories break the south shore, separating the loch into three bays. The west bay is extremely shallow, with a maximum of 6 feet. Two islands lie off the mouth of the river, and round these and to the north the loch is overgrown with weeds. The channel joining it with the mid bay has a minimum of 5 feet, but deepens to 9 feet in the east. The mid bay has also a maximum of 6 feet. The channel leading east from it is 12 feet deep. The eastern expansion deepens from west to east, the maximum of 19 feet being close to the shore. The area of the surface is about 153 acres, or a quarter of a square mile, and it receives the drainage of 16 square miles. It contains 40 million cubic feet of water. The river Loyne, of which the loch is merely a series of

expansions, conveys the overflow to the east loch, half a mile distant and about 13 feet lower.

The surface temperature on May 4, 1903, was 47°·7 Fahr., the air temperature at the same time being 47°·8.

The East Loch.—East Loch Loyne is more than twice as long as the west loch, and is also about twice as deep, but it is much narrower. There are four principal expansions. The western expansion is extremely shallow, having a maximum depth of 7 feet, and on the date of the survey, when the river was in flood, there was a strong current through. There is an island about the middle of it. The channel leading to the second expansion has a depth of 5 to 9 feet. The second expansion is very small, with a maximum depth of 21 feet, and is joined with the third basin by a channel 5 feet deep. The third basin is much the largest, and has more claim to be called a loch, being 1¼ miles in length, with a maximum breadth of fully a quarter of a mile, and but for some large and small islands towards the west end, is a simple basin, with contours parallel to the shore. The area over 20 feet in depth is over half a mile long, with depths of 35 feet in two places—the maximum for the whole loch. The easternmost basin is narrow, two-thirds of a mile long, of uneven bottom, with greatest depths of 20 and 21 feet. The length of the east loch, taken in a straight line between the extreme points, is 2½ miles, the greatest breadth is a little over a quarter of a mile, and the mean breadth is about one-seventh of a mile.

The area of the surface is about 272 acres, or nearly half a square mile, the area draining into the loch being about 24 square miles, including the little Loch na Losguinn and West Loch Loyne. The volume of water is 123 millions of cubic feet. The drainage is chiefly brought by the river Loyne, only small burns contributing a share, the largest entering close to the outflow.

The prominent points on both shores, and the large island, are formed by mounds of boulders and gravel. The only rock seen was at the very narrow channel, with a depth of only 2 feet, at the east end of the largest basin. Here rock was exposed on both sides. The river flows out between an alluvial flat on the north and mounds of glacial *débris* on the south. The height above the sea was 706·1 feet on November 4, 1904.

The temperature of the surface was 46°·6 Fahr., and at 30 feet 46°·2, the air temperature at the same time being 48°·0.

Loch an Staca (see Plate XI.).—Loch an Staca is a considerable minor loch, of roughly triangular form, situated on the extensive elevated area which stretches westward from Loch Ness, between Glens Moriston and Urquhart. It is 6 miles distant from Loch Ness. Its longer axis lies nearly north-east and south-west. The undulating

moorland rises little above the loch, except on the east, where Meall na Criche, 2224 feet in height, sends a long ridge southward between Lochs an Staca and na Criche.

Loch an Staca is estimated to be 1600 feet above the sea. It is a mile long by two-fifths of a mile broad, with a mean breadth of a quarter of a mile. The superficial area of the loch is about 163 acres, or a quarter of a square mile, and the drainage area 1¼ square miles. The volume of water is 110 millions of cubic feet.

Loch an Staca receives only local surface drainage, and the overflow is carried into Loch Liath by a small burn. The bottom is very uneven, a depth of only 9 feet being found almost in the centre of the loch, with deeper water on all sides. There is a small island close to the west shore. A great part of the bottom, equal to 74 per cent. of the total area, is covered by less than 20 feet of water. Four little depressions occur. The deepest, with the maximum depth of 51 feet, is close to the east shore; another of 32 feet lies to the south-west of this; one of 30 feet close to the west shore, north of the island; and one of 30 feet in the centre of the loch, near the north end. At this end is another island. The mean depth is 15½ feet.

The surface temperature (June 2, 1904) was 56°·5 Fahr.; at a depth of 25 feet it was 52°·0, at 50 feet 48°·9, a total range of 7°·6.

Loch Liath (see Plate XI.).—A little roundish loch about a mile to the south of Loch an Staca, on the same plateau. It is about 100 feet lower than Loch an Staca, the drainage from which it receives. The axis of the loch has a north-east and south-west direction. It is barely half a mile long by fully a quarter of a mile broad, with a mean breadth of one-fifth of a mile. The superficial area is about 61 acres, and its contents amount to 62 millions of cubic feet. The drainage area, which includes Loch an Staca, is 4 square miles. Beyond the burn from Loch an Staca, and another from the hill (2222 feet) on the west, it receives only superficial drainage. The burn Allt Bhlair flows out to the south-east, and, joining that from Loch na Criche, enters the river Moriston. The basin is quite simple, the deeper water nearer the south-east side, and the maximum depth of 55 feet towards the north-east end.

When surveyed on June 10, 1904, the level was found to be 1494·1 feet above the sea, which differs little from the level determined by the Ordnance Survey officers on May 15, 1869, viz. 1494·4 feet.

The surface temperature was 56°·9 Fahr.

Loch nam Breac Dearga (see Plate I.).—Situated on the high ground to the west of Loch Ness, about 1½ miles distant from the middle part of that loch. It lies close to the west of Meall Fuarvounie (2284 feet high), which separates it from Loch Ness. The loch is elongate, lying nearly north-east and south-west, and of irregular form, roughly oblong. The

surrounding moorland rises little above the loch, except on the east, where the crags of Meall Fuarvounie rise close beside the loch.

This loch was locally reputed to be of great depth, or even supposed to be bottomless. Though we found it to be the deepest loch in this elevated tract between Glen Urquhart and Glen Moriston, its depth was not remarkable, and not greatly in excess of that of Lochs Liath and an Staca in the same district. It is three-quarters of a mile in length, about one-fifth of a mile in greatest breadth, and one-eighth of a mile in mean breadth.

The superficial area is about 56 acres, and drains about two-thirds of a square mile. It contains 60 million cubic feet of water. It is drained by a burn running some 2 miles south-westward, into the Allt nan Saighead (Alltsigh), which also receives the overflow of a host of little lochs, which were not surveyed, and runs into Loch Ness. The height above the sea was estimated at 1570 feet.

The basin is simple, but deepest towards the upper or north end. The lower portion is all under 25 feet in depth. The areas of over 25 feet and over 50 feet pass obliquely across the loch from south to north. The 50-feet contour encloses a narrow area, about a quarter of a mile long, with the deepest sounding, 70 feet, in the middle of the loch, but nearer the north end.

The surface temperature on June 1, 1904, was 52°·9 Fahr.; at 10 feet, 52°·7; at 25 feet, 48°·2; and at 60 feet, 46°·2, giving a total of 6°·7, the greatest fall being one of 4°·5 between 10 and 25 feet.

Loch a' Vullan (see Plate XI.).—A little loch of triangular form, in the elevated hilly country to the west of Loch Ness, and about 6 miles distant from that loch. It is surrounded by moorland, rising but little above the surface of the loch, except on the south, where Meall na Criche rises in a series of low crags to the height of 2224 feet, nearly 500 feet above the loch. The main part of the loch is triangular, with the apex to the north. From the south-west corner an offset runs one-eighth of a mile to the west, narrow at its beginning, and then expanding. The triangular body of the loch is three-eighths of a mile in length, but the greatest length, from the apex to the end of the west offset, is rather more (nearly half a mile). The maximum breadth in the triangle is one-sixth of a mile, the mean breadth one-tenth of a mile. The height above sea-level was estimated from spot-levels to be about 1750 feet.

Loch a' Vullan receives the overflow of a chain of four small lochs, lying to the north-east. The outflow, controlled by a sluice, is by a small burn, going through a chain of small lochs into the river Enrick. The superficial area is about 28 acres, the drainage area two-thirds of a square mile. The volume of water is 15 millions of cubic feet.

There are two basins in Loch a' Vullan. The larger one, forming

the triangular part of the loch, is simple, with the contours following the shore, the greater part less than 20 feet in depth, the maximum depth being 27 feet. In the narrows separating the small western basin the depth is 13 feet, and in the basin itself 21 feet. The mean depth is 12 feet.

On June 2, 1904, the temperature at the surface was 54°·9 Fahr., and at 20 feet, 50°·0.

Loch Meiklie (see Plate XII.).—A loch of moderate size and relatively broad, situated in Glen Urquhart, about halfway from Loch Ness to Strath Glass, from each of which it is 5 miles distant. Glen Urquhart is a fertile and well-wooded valley. Both north and south of the loch the hills are densely wooded. On the north they rise gradually to over 1000 feet, while on the south they are steeper, and heights of 1700 feet and upwards are reached little more than a mile from the loch. The long axis runs nearly east and west; the length is just over a mile, and the maximum breadth, towards the west end, is nearly half a mile, the mean breadth being over a quarter of a mile. The maximum depth, which coincides with the maximum breadth, is 45 feet, and the mean depth 22 feet.

The area of the surface is about 200 acres, or nearly one-third of a square mile, the drainage area relatively very great, amounting to nearly 42 square miles, and including many small lochs, of which only Loch a' Vullan was surveyed. The river Enrick is the only important stream flowing into Loch Meiklie, and the outflowing river, still bearing the same name, flows into Loch Ness in Urquhart bay. The surface of the water on October 3, 1903, was 364·9 feet above the sea; on June 22, 1867, the Ordnance Survey officers found it about 6 feet higher (371·5 feet).

In form Loch Meiklie is approximately oblong. A shallow inlet, formed by the encroachment of the river, runs one-sixth of a mile from the west end. The basin is quite simple, with the slopes everywhere gentle, but steepest towards the north shore at the deepest part. Over one-half of the whole area is less than 20 feet in depth. The volume of water is 193 millions of cubic feet, making Loch Meiklie the ninth in point of bulk in the Ness basin.

The surface temperature on October 3, 1903, was 53°·6 Fahr., the air temperature at the same time 51°·0.

Loch Aslaich (see Plate XI.).—An extremely beautiful little loch, about 5 miles west of Loch Ness, surrounded by hills of considerable height, rising to about 2000 feet in the immediate neighbourhood of the loch. On a picturesque wooded island in the loch the members of the Lake Survey had their abode (in a lodge kindly lent by the proprietor), while the lochs of the district were being examined. In form the loch

is a narrow oblong, with its long axis running north and south. It is one-third of a mile long, with a maximum breadth of one-seventh of a mile. Its superficial area is about 21 acres (only Lochs Dubh and nan Losganan being smaller), and it drains an area of nearly 2 square miles. This area includes a larger loch (Loch nam Meur), which was not surveyed. Besides the chief feeder, the burn coming from Loch nam Meur, two small burns enter the loch. The river Coiltie has its origin in Loch Aslaich, and flows into the Enrick just where it enters Loch Ness. Its volume is 10 millions of cubic feet; in this respect Lochs Lundie (by Clunie), Laide, Dubh, and nan Losganan, are smaller. The height of the loch above the sea was estimated at 1310 feet. Fully half the superficial area is covered by less than 10 feet of water. The area of more than 20 feet in depth forms a narrow strip along the west side. This comes very near to the south end, and the deepest sounding, 26 feet, is quite close inshore. The mean depth is 11 feet.

On July 2, 1904, the temperature at the surface and at 6 feet was 60°·0 Fahr., and at 18 feet, 56°·3.

Loch Dubh (see Plate I.).—A very little lochan a couple of miles to the west of Loch Ness and 4 miles south of Glen Urquhart. The shortest loch in the basin, but in all other dimensions the second smallest, since Loch nan Losganan is shallower, narrower, of smaller area and volume. It is obscurely triangular in form, its axis running south-west and north-east, the apex to the north-east. It is situated at a high level, estimated at 1340 feet, amid moorland, rising gradually southward to Meall Fuarvounie (2284 feet). It is nearly one-fifth of a mile in length, and one-ninth of a mile in greatest breadth. It is only about 8 acres in area, and drains an area of over 100 acres. Its volume is 2 millions of cubic feet, twice that of Loch nan Losganan. It drains by a small burn into the river Coiltie. The basin is simple, with evenly sloping sides, and the deepest sounding of 18 feet almost in the centre.

Loch Laide (see Plate II.) is a little shallow round loch, measuring just about one-third of a mile in diameter, lying at a considerable elevation among the hills to the west of Loch Ness, near its northern end, above Abriachan, and about 1½ miles distant. It is surrounded by moorland and low hills, rising on the south side nearly 600 feet above the loch (Carn an Leitire, 1424 feet), within a distance of half a mile. There is no bench-mark nearer to the loch than the summit of this hill. On August 4, 1869, the Ordnance Survey officers found the height above sea-level to be 859·8 feet.

The superficial area of Loch Laide is about 39 acres, and it drains an area of 1½ square miles. It has a volume of water of 9 millions of cubic feet, only two lochs in the Ness basin (Lochs Dubh and nan Losganan) being less in volume. It is fed chiefly by one small burn, rising some

2 miles to the south-west, and the overflow is carried by the Allt Loch Laide into Loch Ness at Abriachan. The bottom of Loch Laide is very uneven. The greatest depth, 9 feet, is found close to the east shore. In the centre the depth is only 4 feet, and other soundings of 3 and 4 feet are found far out. There are low islands near shore to the south and west. The mean depth is just over 5 feet, or fully half the maximum depth.

The surface temperature on May 20, 1904, was 52°·3 Fahr.; at 5 feet, 51°·7; and at 8 feet, 51°·3.

Loch Tarff (see Plate I.).—Loch Tarff is a beautiful loch of triangular

FIG. 3.—LOCH TARFF, LOOKING NORTH-EAST.

(*Photograph by Mr. G. West. From 'Proc. Roy. Soc. Edin.,' by permission of the Council.*)

form (see Fig. 3) lying high among the hills to the east of Loch Ness, from which it is about a mile distant, and 3 miles north-east of Fort Augustus. There are several large and small islands, some of which are covered with trees. Rocky hills rise on all sides, but to no great height above the loch in the immediate neighbourhood. Beinn a' Bhacaidh (1813 feet) on the north is 850 feet above the loch. The high mountain range, culminating in Corrieyairack, is more distant on the south-east. The outline is almost an equilateral triangle. The shores are undulate. The large Eilean Ban is close to the shore on the north-east. On April 25, 1903, the elevation of the lake-surface was 956·2 feet above the sea, almost identical with that observed by the Ordnance

Survey officers on July 17, 1866, viz. 956·3 feet. The greatest diameter measured from north-west to south-east exceeds two-thirds of a mile. The maximum breadth, taken at right angles to the line of greatest diameter, is fully half a mile, the mean breadth being over one-third of a mile. The superficial area is about 131 acres, and the contents 136 millions of cubic feet. The drainage area is rather over 1 square mile. Some small burns come in from the hills to the north, and the overflow is carried into the Doe burn, a mile to the south-west, and so into Loch Ness.

Loch Tarff is shallow. Though it has a maximum depth of 89 feet, the mean depth is only 24 feet, nearly two-thirds of the area being less than 25 feet deep. The bottom is irregular, there being three separate basins over 25 feet in depth. Two of these are unimportant and lie towards the south-east shore, with maximum depths of 27 and 42 feet respectively. The largest 25-feet area lies to the north-west of Eilean Ban, and stretches from south-west to north-east nearly across the loch, with a breadth of one-fifth of a mile. It encloses a small 50-feet area and a very small area of over 75 feet, both to the north of the centre and nearer the north-east shore, the maximum sounding, 89 feet, being found about halfway between the island and a rocky point north-west from it.

A series of temperatures taken in the deep part on April 25, 1903, showed a range of only 1½ degrees, as shown in the following table:—

Surface	42°·8 Fahr.
20 feet	42°·8 „
40 „	42°·0 „
80 „	41°·3 „

The air temperature at the same time was 51°·2.

Loch Knockie (see Plate I.).—A loch of moderate size and very irregular form, about a mile east of Loch Ness, opposite Invermoriston. It is a beautiful loch, with great parts of the shores wooded, and several tree-clad islands (see Fig. 4). It is narrow, with the axis running nearly south-west and north-east. The shore-line is undulating. A large broad bay runs off to the north-west, and there are several smaller bays on the south-east shore. The length is 1¼ miles, the maximum breadth half a mile, and the mean breadth one-fifth of a mile.

The superficial area is about 182 acres, or a little over a quarter of a square mile, and the volume of water 194 millions of cubic feet. It has a very limited drainage area, amounting to only about 1⅔ square miles. No large stream flows into it, and a short burn carries the overflow into Loch nan Lann. There is no bench-mark near, but a spot-level on the shore indicates that the loch is a few feet less than 700 feet above the sea.

Loch Knockie is on the whole shallow, as indicated by the low mean depth, 24½ feet, and by the fact that two-thirds of the area of the loch is less than 25 feet deep. Both ends are shallow beyond the two narrows which constrict the loch, the deepest part in the north-east portion being 26 feet, and in the south-west portion 32 feet. Both the narrows are 20 feet deep. The central basin between the narrows is deep, and the 25-feet and 50-feet contours follow the shore and enter the west bay. The greater part of the basin is over 25 feet deep, the 50-feet area being nearly half a mile long, but narrow. The 75-feet basin is based on a single sounding in 75 feet, the maximum depth of the loch.

FIG. 4.—LOCH KNOCKIE, LOOKING NORTH-EAST.
(*Photograph by Mr. G. West. From 'Proc. Roy. Soc. Edin.,' by permission of the Council.*)

Loch nan Lann (see Plate I.).—A small loch of relatively great depth, situated between Loch Knockie and Loch Ness, joined with Loch Knockie by a short stream a quarter of a mile long. Loch nan Lann lies due north and south, and is narrow towards the north and broad towards the south end. There is a constriction in the middle of the loch, with a small and shallow expansion to the north of it, and a broad and deep basin to the south. The axis of the loch is considerably curved. The east shore is wooded. The length is nearly three-quarters of a mile, the greatest breadth one-third of a mile, and the mean breadth about one-seventh of a mile. The superficial area is about 65 acres, and the contents amount to 105 millions of cubic feet. The drainage area includes Loch Knockie, and amounts to 3¾ square miles. It is

fed chiefly by the burn from Loch Knockie. The outgoing stream leaves the loch at the north extremity, and flows half a mile north-westwards into Loch Ness.

North of the narrows the loch is deeper close to the west shore, and the greatest depth in this part is 41 feet. South of the narrows the expanded portion is a regular and simple basin. The contours are fairly concentric with the sides of the basin, the slope pretty uniform all round, but rather more gradual from 25 to 50 feet. The narrow 100-feet area is an eighth of a mile long, and is a very little to the south-west of the centre. The maximum depth is 109 feet. The loch is approximately 645 feet above the sea.

The temperature at the surface on April 24, 1903, was 42°·0 Fahr.; at 15 feet, 41°·8; at 25 feet, 41°·3; at 50 feet, 41°·0; and at 100 feet, 41°·0, the whole range being one degree.

Loch Kemp (see Plate I.).—A small loch east of Loch Ness, 3 miles to the south of Foyers. It is of rather irregular form, roughly oblong, with an arm running off to the north, and bays to the east and west. The shore is entirely of rock, and it is surrounded by low hills. The length is half a mile, the greatest breadth a quarter of a mile, the mean breadth scarcely less (one-fifth of a mile). The superficial area is about 68 acres, and the volume of water 77 millions of cubic feet. The drainage area is $1\frac{1}{2}$ square miles. Two small burns enter to the south and east, and the outflowing stream goes half a mile north into Loch Ness. On April 23, 1903, the loch was 577·8 feet above sea-level; on August 4, 1869, the Ordnance Survey officers found it to be 577·4 feet.

The bottom is flat, with a central depth of 41 feet. The 25-feet contour closely follows the shore, but does not go into the north arm, in which there is an isolated sounding of 25 feet. The maximum of 51 feet occurs in a little hole close to the shore, in the south-east corner of the loch, the mean depth being $26\frac{1}{4}$ feet.

Temperature of the surface, 42°·0 Fahr.; at 25 feet, 42°·0; at 50 feet, 41°·8.

Loch nan Eun (see Plate XIII.).—A dark and desolate tarn lying at the foot of the wild and bare Cairn Vangie. The loch lies in a deep valley, and a boat was with difficulty transported down the steep hill from the road. Glen nan Eun runs here nearly east and west. The Cumrack burn flowing out from the loch runs to the north-east and becomes the river Foyers. The surface is about 915 feet above the sea. The length is barely half a mile, and the greatest breadth about one-sixth of a mile. The superficial area is about 35 acres, and the contents 15 millions of cubic feet. The drainage area is nearly 4 square miles, and the chief feeder is the nan Eun, coming from the south-west.

Loch nan Eun is somewhat oblong, and is a simple basin of no great

depth. The slope of the bottom is steeper on the south, and very gentle on the north. The maximum depth of 21 feet is near the south shore; the mean depth is 10 feet.

On April 25, 1903, the temperature at the surface was 42°·5 Fahr., and at 20 feet, 42°·1.

Loch Killin (see Plate XIII.).—Loch Killin lies high up among the mountains on the east side of Loch Ness, about 10 miles east of Fort Augustus. It is a narrow loch of moderate size, the valley which it occupies running at that part nearly south to north. On the west the precipitous crags of Creag Acain rise abruptly from the shore of the

FIG. 5.—LOCH KILLIN, LOOKING SOUTH-EAST.

(*Photograph by Mr. G. West. From 'Proc. Roy. Soc. Edin.,' by permission of the Council.*)

loch to a height of 1000 feet above its surface. Equally high hills rise more gradually on the east (see Fig. 5).

Loch Killin is narrow to the north and broadens to the south, the maximum breadth of a quarter of a mile being just a quarter of a mile from the south end. The mean breadth is about one-sixth of a mile. The length is considerably over a mile. The loch has a superficial area of about 130 acres, and contains 137 millions of cubic feet of water. Loch Killin has a large drainage area, extending to $38\frac{1}{2}$ square miles, the river Killin, which enters on the south, bringing the drainage of several large glens. The river flowing out to the north is called the Fechlin, and is one of the chief sources of the river Foyers. At the

head of the glen, 6 miles south of Loch Killin, is Loch na Lairige, which was not visited. The height above sea-level is about 1044 feet.

Loch Killin is of very moderate depth, with a flat bottom. More than half the area of the loch (58 per cent.) is covered by less than 25 feet of water. The area over 25 feet in depth is all south of a little rocky point on the west shore, and is fully half a mile long, the contour following the shore closely. The area over 50 feet in depth, a quarter of a mile long, approaches close to the foot of the cliffs on the west, and the maximum sounding of 67 feet is not far from shore. The mean depth is 24 feet.

The temperature on April 24, 1903, was almost uniform throughout —surface, 36°·9 Fahr.; 50 feet, 36°·8.

Loch nan Losganan (see Plate XIII.).—A mere shallow pond with a maximum depth of 7 feet. It is narrowly triangular, its axis curved, and is narrow and elongate to the west. It lies about 4 miles south of Foyers on Loch Ness, and is connected by a small burn with the river Foyers. Though from its elongate form it is not quite the shortest in the Ness basin, in all other respects it is the smallest. In length it is nearly one-third of a mile, and its greatest breadth is one-tenth of a mile. The superficial area is only about 7 acres, its volume only 1 million of cubic feet, and its drainage area a quarter of a square mile.

The temperature of the water on April 21, 1903, was 42°·8 Fahr.

RECESSION OF ALASKAN GLACIERS.*

By OTTO KLOTZ, LL.D., F.R.A.S.

In No. 5, vol. 14, for November, 1899, of the *Geographical Journal* appeared an article, "Notes on Glaciers of South-Eastern Alaska and Adjoining Territory," with photographs and maps, by the writer. Particular attention was given to the comparison of the position of the fronts of the glaciers flowing from the *névés* surrounding Mount Fairweather and Glacier bay between the times of La Perouse and Vancouver and the year 1894, when the Canadian Boundary Commission occupied that field.

It may be well to repeat here the conclusions arrived at from the above comparisons. In Lituya bay the glacier in the northerly arm advanced 3 miles, in the southerly arm $2\frac{1}{2}$ miles, during the period 1786–1894. In Taylor bay, just east of Cape Spencer, the ice-front, Brady glacier, advanced 5 miles, 1794–1894, and the "deserted village" (Indian) of Vancouver was covered by nearly 1000 feet of ice.

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* Communicated by permission of chief astronomer.

Coming now to Glacier bay, into which discharge the Muir, Johns Hopkins, and Grand Pacific glaciers, it was shown that the ice-front had receded in a north-westerly direction 45 miles in one hundred years, or at the rate of nearly half a mile a year. For all the glaciers, living and dead, eastward and southward, recession was noted, and of varying degree.

As far as the climatic conditions are concerned, we are justified in assuming, for so limited an area of the Earth's surface, that they were the same for any given time, *i.e.* if there was a heavy precipitation, (snowfall) for the *névé* of one glacier it was similar for another. The *névés* are the feeders of the glaciers, and if the snowfall is greater than the evaporating and melting, then the snow accumulates, the *névé* increases in volume and gradient, with an increased flow and advancement of the glacier. The anomaly of progression and recession during the same interval of time becomes more perplexing when it is remembered that the *névés* of the glaciers mentioned are practically contiguous; in fact, the Brady and Grand Pacific glaciers are like a large straight ice-band laid across the peninsula, one end discharging to the south and the other to the north; while the one advanced, the other receded. So far, no data have been obtained to explain the anomaly, nor why either event should happen. In short, there is no meteorological evidence available as to what the condition of the glaciers should have been at a given time. The area spoken of is subject at times to seismic disturbances which do affect glaciers, and in two ways. In the first place, for living glaciers the ice-front may be broken off to a considerable extent, showing thereby apparent recession, but this amount would be small compared with the change otherwise brought about in a series of years. In the next place, an earthquake may produce—as it did very markedly in Yakutat bay in 1899, when the shore-line rose upwards of 47 feet—a change in the relative position of land and water, by depressing or raising the former. Let us take as an example a depression of the land of 50 feet, and a gradient for the glacier of 1°, which is a small gradient for Alaskan glaciers. The result would be a submergence or recession of the glacier for less than 3000 feet, or a little over half a mile. If the gradient be greater, then the submergence will be less. Although the advance or recession of half a mile is a large amount when taking place suddenly, yet within not very many years it would play but a small part in the general movement of the glacier. The effect of earthquakes, then, as we know them, does not appear sufficient to offer a satisfactory explanation of the anomalous movement of the ice. Having given the above *résumé*, it is interesting to be able to give a few more data with reference to two of the glaciers mentioned, the Johns Hopkins and the Grand Pacific. From observations made during the present year, it appears that since 1894 the Johns Hopkins glacier has receded nearly

7 miles in the thirteen years, or at an average rate of nearly half a mile a year, which was the average rate found for a period of a hundred years, as given above, for the ice-front. The smaller and adjacent Grand Pacific has receded during the same time not so much, the distance being about $3\frac{1}{2}$ miles.

Of all the living or calving glaciers on the Earth, none are more favourably situated for studying the movement of these ice-rivers than those of south-eastern Alaska. For the study of these movements it is essential to have good topographic maps for reference. The area under consideration has been pretty well covered with photographic stations, tied to a triangulation. From this not only pictorial or perspective records of the glaciers have been obtained, but by the employment of the photographic camera of fixed focal length, and using the yellow screen for securing distant views effectively, the horizontal and vertical elements of the photograph are obtained and a topographic sheet with contour-lines evolved, giving an indisputable record; there is no error in reading any angles, for the angles are taken from the photographs. Another advantage of this region is its comparative accessibility, and as the stations are almost invariably natural features, they can be readily identified and again occupied.

As indicated in my former paper, the photo-topographic method is the most reliable, and, at the same time, the simplest for the study of the movement of glaciers.

GEOGRAPHY AT THE BRITISH ASSOCIATION.

The British Association met this year at Leicester, and Section E (Geography) was occupied with lectures from Thursday, August 1, until Tuesday, the 6th. The president of the section was Mr. G. G. Chisholm; vice-presidents, elected either before or during the meeting, were Mr. J. Bolton, Major C. F. Close, Colonel Sir D. A. Johnston, and Dr. H. R. Mill; the secretaries were Messrs. E. Heawood (recorder), E. A. Reeves, O. J. R. Howarth, and Theodore Walker, the local secretary, to whom the section, and especially his colleagues in office, were much indebted. The other members of the committee were Dr. Tempest Anderson; Mr. A. W. Andrews; Captain T. T. Behrens; Dr. Vaughan Cornish; Prof. Max Eckert; Mr. H. T. Ferrar; Major W. L. Forbes; Mr. J. Stanley Gardiner; Prof. J. W. Gregory; Mr. J. McFarlane; Mr. H. J. Mackinder; Mr. E. Delmar Morgan; Mr. R. D. Oldham; Staff-Commander E. Dubois Philips; Mr. J. Howard Reed; Mr. H. Richardson; Prof. J. W. Spencer; Mr. Mark Sykes; Mr. J. Thomson. An excellent meeting-place, the County Assembly Rooms, was allocated to the section.

The opening address by the President of the Association, Sir David Gill, was of particular interest to Section E, since, among other subjects, he dealt with geodetic surveying in Africa, to the development of which he looks keenly forward. He pointed out that continuous triangulation now exists "from Cape l'Agulhas to within 50 miles of the southern end of Lake Tanganyika," and he looked forward to the ultimate completion of triangulation from the same cape to Cairo, and the

establishment of a connection thence to unite with existing triangulation, which would carry the whole to the North cape—"an arc of 105° in length—the longest arc of meridian that is measurable on the Earth's surface."

On the Thursday, following upon Mr. Chisholm's presidential address to the section (printed *in extenso* in the *Journal* for September), Mr. Howarth read a paper on "The District of Jaederen in Southern Norway." He described in some detail the coast of this district, the chief of the few points on the West Scandinavian seaboard where the island-fence and the series of fjords are interrupted. He contrasted the flat boggy coastal strip immediately south of Stavanger, with its shingly shore and dense population, with the rocky region further south, which is inhospitable, scarcely inhabited, intensely glaciated, and has a sandy and rocky coast. He showed how this part of the coast had risen, so that what had been some small fjords and islands were now dry, and incidentally contrasted two classes of Norwegian fjords, one deep, with islands off the mouth, the other less deep, and open-mouthed. Prof. Max Eckert had provided a paper on "Commercial Geography from the Modern Standpoint." He was present, but Mr. Chisholm read his paper. This was, in a sense, an additional chapter to Mr. Chisholm's own presidential address. Prof. Eckert showed how commercial geography must correlate the natural conditions of any given locality with the political, and thus arrive at a conception of its possibilities in the way of production and commerce. He showed the wide field over which the consideration of natural conditions must extend, taking every factor into account from latitude and altitude to climate, geology, orography, water-supply, etc. He insisted on the necessity of studying the regional distribution of the various methods of transport. In the afternoon a joint meeting was held with Sections C (Geology) and K (Botany) to hear Prof. Conwentz lecture on "The Preservation of Natural Monuments." This term, "natural monuments," was used in a very wide application by the professor, who indicated by it every aspect of the land in a state of primitive nature, as distinct from the land as superficially altered in the course of human settlement, according to the dictates of agriculture or other industry. With the object of preserving certain natural features intact, efforts have been made in many localities, and in Prussia a special department of State under the Ministry of Education exists to further such efforts. The professor gave instances of similar local work in Britain, urged its extension, and suggested that the British Association might further it as co-ordinating authority.

On the Friday morning Major C. F. Close read a paper on "The Surveys of British Africa," in which he showed that survey departments exist and are at work in the Anglo-Egyptian Sudan, Uganda, East Africa, Southern Nigeria, and the Gold Coast, and that an exact topographical survey is in progress in the Orange River Colony, and a military reconnaissance survey in Cape Colony. About 45,000 square miles will have been topographically surveyed this year, and, besides this, the work of boundary commissions, cadastral surveys, and various compilations must be taken into account. In opening a short discussion on this paper, Sir David Gill said that the first essential of colonial administration is a good map; he deplored the fact that the action which the Colonial Office is now taking was not taken much earlier. Colonel Sir D. Johnston alluded to the advisory committee for survey work established by the Colonial Office, and noted a general improvement in methods; and Mr. A. R. Hinks bore witness to the value of the Report on Surveys in Africa as an educational text-book. The next paper, by Captain T. T. Behrens, dealt with "The Modern Explorer: his Maps and Methods." Captain Behrens pointed out the extent to which atlas maps are dependent merely on the route-surveys of explorers. He indicated the great difference between one and

another of these surveys in accuracy and elaboration, and showed how the extension of detailed surveys was rendered not only possible, but economically desirable, by the opening up of new lands. By means of lantern slides he illustrated methods of field work in East Africa and Uganda. Prof. J. W. Spencer followed with a treatise on "The Recession of Niagara." His recent survey on behalf of the Canadian Geological Survey has shown that since 1842 the mean annual rate has been 4·2 feet, the average breadth of the gorge being 1200 feet. A longer record, agreeing generally with the above, has been obtained by studying the description and sketch of Father Hennepin in 1678. Since 1890 the rate has, however, diminished. Prof. Spencer carried out, under considerable difficulties, a series of soundings below the falls. The apparatus reached the fallen rocks immediately beneath at 72 feet, while lower down the floor of the river was 84–100 feet below the surface, a lateral inner gorge reaching a depth of 192 feet. At the whirlpool a depth of 126 feet was measured, but this probably did not represent the maximum. Near the falls, the bottom is about 90 feet below the surface of Ontario, while in the narrow inner channel it sinks to 180 feet below. The aggregate height of all the different parts of the falls is more than 500 feet. Prof. Spencer drew some conclusions as to the past history of the falls. Originally the volume was only 15 per cent. of the present, but it was brought up to its full amount by the accession of the drainage of the three uppermost lakes, as a result of a tilting of the surface, culminating 3500 years ago. Prof. Spencer calculates that while it took 35,000 years to cut the first three miles of the gorge, the last four have been formed in 3500. Mr. H. T. Ferrar read a paper on "The Physical Geography of the Etbai Desert of Egypt." Among the features of special interest to which he alluded were the centripetal arrangement of the Wadis draining westward to the Nile, the beheading of the west-sloping wadis by the steeper ones sloping east, the curious forking or branching of some wadis (*mushels*) owing to the aggraded condition of their beds, and the indications of a former fluvial period in the physical history of the region, as proved by the occurrence of high-level gravels and alluvium, the wide distribution of celts, etc. Mr. Ferrar further explained a number of Arabic geographical terms. In the afternoon Mr. Mark Sykes gave a lecture on "The Kurdish Tribes of Asiatic Turkey," an interesting conglomeration of tribes to which little justice has been done by historians and scientists. In the course of his journeys among them, Mr. Sykes has distinguished some 323 tribes and subtribes, varying so widely in appearance, mode of life, civilization, and religion, that he would not lay down any general statements concerning them. As to language, a number of dialects are said to fall into two broad divisions, called Zaza and Kermanji. Mr. Sykes indicated the geographical distribution and grouping of the Kurds on an original map, and his fine photographs attracted much interest. It was unfortunate that the time of Mr. Sykes' paper coincided with that of one of the principal social functions held in connection with the meeting of the association.

The Saturday was, as usual, devoted to excursions, of which that of chief interest to geographers had Charnwood Forest as its objective.

On the Monday, Mr. A. W. Andrews read a paper entitled "The Land's End Peninsula: a Regional Survey." Mr. Andrews described the granite plateau and its superficial features, and alluded to its present state of depopulation and the decay of its industries, notably of course its tin-mining. He indicated the existence of a narrow coast plain, less than a mile in width, which was probably covered by the sea in Pliocene times up to the present elevation of 340 feet. There is in general, however, a lofty coast with fine cliffs (of which Mr. Andrews showed many beautiful lantern slides) and almost without harbours. The slope from the summit of the plateau is longer towards the south than towards the north; there is also

a far milder climate and a richer soil, and such industries as market-gardening are practised. To the east a low neck separates the peninsula from the rest of Cornwall, and Mr. Andrews, in indicating the character of the peninsula as an isolated area of old rock, introduced a local interest by comparing it, in this respect, with Charnwood Forest. Mr. J. Macfarlane gave a paper on "The Hinterland of the Port of Manchester," in which he contrasted the area of distribution of various imports from the port; *e.g.* grain, he said, is dispatched over an area extending 12 miles west, 20 miles north, eastward to Leeds, and southward about 100 miles, meeting the competition of other ports at these limits. He contrasted the trade in West Indian bananas, a trade shared with Bristol alone; so that the area of distribution from Manchester over England is in this case much wider. The geographical possibilities of Manchester as a port, in the reader's opinion, are great, and there are many signs of the development of trade, in spite of the apparently small success of the ship-canal hitherto, which he attributed in great measure to the "momentum" acquired by ports of older establishment; he also gave instances of the adverse influence of shipping rings. In the author's absence, the Recorder read a paper on "The Geographical Evolution of Communications," by Prof. Vidal de la Blache. This paper showed the influence of geographical conditions on the development of methods of communication. When once man had succeeded (in many different countries independently) in domesticating beasts of burden and using them for methods of transport, this feat profoundly influenced his migrations, as in Central Europe. The great expanse of plains in the midst of the Eurasian continent were favourable to communication over long distances, and many improvements in methods of wheeled traffic had their origin there. In the afternoon a large audience gathered to hear Dr. Vaughan Cornish give "A Narrative of the Jamaica Earthquake," and his account of the experiences of himself and his wife, in escaping from the wreck of the house in which they were at the time of the great disaster in January, proved of intense interest. He then described events which he witnessed in Kingston during the terrible days which followed, showing many lantern-slides, and finally indicated the methods of his inquiry, made during a second visit in May to July, into the place of origin of the earthquake, the direction and character of the shock, and its more notable effects on buildings, etc. A brief indication of the results of these investigations, which are not yet fully worked out, was given.

On the Tuesday, Mr. R. B. Woosnam gave his paper entitled "An Expedition to Ruwenzori." He indicated the route of the expedition, from Mombasa by Ruwenzori to the West Coast, and illustrated his description with photographs taken in Uganda, the Ruwenzori region, the Semliki valley, and the forests of the Congo, and some examples of the pygmy tribes met with were also shown. Turning then to Ruwenzori specifically, Mr. Woosnam dealt with the flora and fauna of the range, with especial reference to the zonal distribution of genera and species at different altitudes. His photographs of characteristic plants were especially admired. Mr. M. M. Allorge read a short paper, illustrated by lantern-slides, on the cave of Atoyac, in Mexico. This cave, discovered in the summer of 1906 by Señor Sanchez, occurs in a zone of limestone of Middle Cretaceous age, traversed by the Vera Cruz—Mexican railway between the 80th and 180th kilometre and forming a spur of the Western Sierra Madre. Rivers are here often engulfed, and there is an extensive system of underground channels, some still filled with water, others, at higher levels, mostly dry. The cave of Atoyac is of the latter class, its mouth lying amid steep slopes 85 feet above the present level of the river. It is partially closed by *débris*. The strike of the rock is approximately north to south, the dip 75° E., and the jointing roughly perpendicular to the strike. Within, there is a

succession of passages and chambers showing a marked rectangular arrangement. A transverse corridor is partially closed by blocks which have fallen from the roof, damming back the water. The author showed that the work of excavation by the water has been controlled down to its most minute details by the planes of bedding and by the system of joints and fractures. As far as the dam, remains of pottery have been found, proving that the cave was used by Indians some five centuries ago, while it probably served as a shelter in much earlier times. The morning's sitting was concluded with an announcement as to the work of the special committees appointed to deal with the subjects of (1) Investigations in the Indian Ocean; (2) Rainfall and Run-off; (3) Oscillations of Land-level in the Mediterranean. Grants for the further prosecution of the work of the two first had been made the previous day by the Committee of Recommendations. In the afternoon Mrs. Leonidas Hubbard gave an account, illustrated by lantern-slides, of her "Traverse of Two Unexplored Rivers of Labrador," namely, the Nascaupee and George rivers. Her husband lost his life during exploration in this region in 1903, and Mrs. Hubbard undertook to complete his task. Her journey of 600 miles lasted from June 27 to August 27, 1905. She was accompanied by four men, and in six weeks the party traced the Nascaupee to its source, passing up a succession of rapids by which the river descends a series of steps or terraces from the Height of Land. They then found the source of the George river in Lake Hubbard, and followed it down to the Hudson Bay Company's post near Ungava bay. At first they passed through a series of lake-like expansions; next, leaving the high plain on which these are situated, they followed three successive narrow gorges, and finally had an exciting journey down the last 132 miles of the river, which consist almost entirely of rapids. Interesting incidents of the journey were the encounters with innumerable caribou on the Height of Land, and the meetings with two friendly bands of Indians, of whom naturally little is known in this region. Lastly, Dr. W. M. Strong, who had just arrived in England from New Guinea, gave a short sketch of the geography, tribes, and economic prospects of the British part of the island.

REVIEWS.

EUROPE.

The Rainfall of North Germany.

'Die Niederschlage in den Norddeutschen Stromgebieten.' In amtlichem Auftrage bearbeitet von Prof. Dr. G. Hellmann. Berlin: Reimer. 1906. Vol. 1, pp. v., 386, 139; 48 figs., 3 plates, 1 map. Vol. 2, pp. vii., 722. Vol. 3, pp. vii., 872.

The first volume of this elaborate monograph contains a discussion of the results of a long and patient investigation of the rainfall statistics printed in the second and third volumes. The first section discusses the materials available, the distribution of stations, the adequacy of rainfall measurements, and gives a bibliography of works on the rainfall of the German Empire or of regions where precipitation affects rivers flowing across that empire. The second section deals with the amount of rainfall and its yearly distribution, illustrated by ten very useful sketch-maps—to which we shall return—and the maximum rainfall in a day and in shorter periods. The third section is concerned with rain-frequency, the number of rain-days, and the period of the year when such days are most and least numerous, the number of days on which snow falls, the periods of the year when they occur, and, finally, the days on which hail and sleet fall.

The fourth section treats of variations in rainfall, mean and extreme, the succession of dry and wet spells, and the periodicity of rainfall variations. In the last section Dr. Hellmann shows that by smoothing the curve by means of the reduction formula $(a + 2b + c) \div 4$, a double rainfall maximum occurs for each sunspot period, the larger rain-maximum at the period of minimum sunspots the smaller rain-maximum at the period of maximum sunspots—as thirty years ago Meldrum found for Mauritius, and more recently the late Dr. Buchan for Scotland. Dr. Hellmann, however, adds the warning, which some in this country have long been urging, that the rainfall in different parts of a baric region may be differently affected by solar variations. The effort to show a thirty-five years' periodicity, which was first suggested by Bacon in 1622, and worked out by Prof. Brückner in 1890, indicates what has become clearer with more exact data, that any such periodicity is not simple, but is due to the superposition of different periodicities.

After some remarks on different stations, the author adds a note on the rainfall map of the German Empire based on the means for 1893–1902, which, with three plates of curves of monthly rain and monthly rain probability, and of rain probability in pentads, are appended to the first volume. An index to stations is added, but there is no subject index—a very serious omission in a work of this kind.

The geographical side of this work is naturally that which interests most of the readers of this *Journal*. The treatment of it is incidental and somewhat scrappy, and we repeat that it is not dealt with in the same thorough way as the meteorology. The president of the Berlin Geographical Society is so intimately acquainted with the subject that we trust he will crown his work by discussing in detail the geographical control of rainfall in the German Empire, and continue the monographs which he has begun in his paper on the rainfall of the Flat Coasts.*

We may summarize here the general conclusions drawn by the author as to the distribution of mean annual rainfall.

1. The rainfall diminishes from west to east.
2. The flat coast is slightly drier than the adjacent land (10 to 60 mm.).
3. The rainfall is greatly influenced by altitude, and the rainfall map, to a certain extent, is a relief map; but relative height, and the position of the station with respect to the prevailing winds, are more important than absolute height. The isohyets are lower on the east than on the west of highlands.
4. This influence of height is very marked in North Germany, where the Lüneberg heath, the various divisions of the Baltic heights, and other heights of the plains are shown on the map as areas of greater rainfall. The gradual rise of land from the plain is also indicated by increase of precipitation.
5. The valleys, when the middle courses of the rivers are through hills, are drier than the surrounding districts.

A map based on ten years' observations, as Dr. Mill has shown, is not a thoroughly satisfactory representation of the mean rainfall of a country. The author calculates that, in the present map, the values for north-east and east are from 4 to 9 per cent. too high when compared with those for fifty years' mean, while those for the west and south-west are from 2 to 7 per cent. too low.

The greatest rainfall in the German Empire is in the mountains, where also the heaviest precipitations in short periods are also recorded. The highest mean annual fall is found at the summit of the Sulzer Belchen in the Vosges (212 cms. = 83 inches); but the western side of the Alsatian Belchen, which is in France, is probably the wettest place in these highlands. Equally rainy is the south-east

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* 'Ueber die Regenarmut der Flachküsten.' Sitzungsberichte d. König. preussischen Akad. d. Wissens, liv. 1904.

corner of the Bavarian Alps; but here again the maximum for the region is outside German territory. The Schwarzwald has from 180 to 200 cms. in the highest parts, while the Brocken stands out in North Germany with a rainfall of 170 cms. Four considerable areas have less than 50 cms. (20 inches) of rainfall per annum—(1) Posen and the lower Vistula (minimum at Pakosch, in the district of Mogilno, 41 cms.); (2) the lower Oder; (3) the Saale-Elbe valley between Halle and Magdeburg; and (4) the middle Rhine plain between Mannheim and Bingen (minimum, 43 cms. at Grünstadt).

While 50 per cent. of the rain falls in the winter half-year (October to March), in the extreme west only 35 per cent. falls in winter east of a line from the Moravian Gate through Warsaw. From one-third (in the west) to two-fifths (in the east) of the rain falls in the summer three months, and from 24 per cent. in the west to 16 per cent. in the east in the winter three months. In the spring three months the contrast is between the north, which receives under 20 per cent., and the south, which has 24 per cent. of the annual rainfall; but in autumn it is much the wetter there, receiving over or nearly 30 per cent. near the coast, compared with from 22 to 24 per cent. in the south, which is thus better favoured. June is the wettest month in the south, July in the centre and north, except in the extreme north-west, where August or October are the rainiest months. January is driest in the south, February in the east, and April in the north-west and along the margin of the Baltic. The probability of rain is least in September for the whole of middle Germany from the middle Rhine to the Vistula, but north of this April is the happy month, to the south January in the upper Danube, and November in Bohemia. As might be expected, the Rhine valley and North sea margin have least snowy days—under thirty—while in the far east the number is just double.

No one can examine these volumes without admiration of the great industry of their author and his collaborators, and without being impressed by the enlightened action of a Government which supports a staff sufficient for the work, and is generous enough to secure its publication.

A. J. H.

ASIA.

The Caucasus.

Kaukasus, Reisen und Forschungen im Kaukasischen Hochgebirge.' Von Moriz von Déchy. In drei Bänden. Berlin: D. Reimer. 1905–7. *Price*, vols. 1 and 2 (together), 40 *m.*; vol. 3, 40 *m.*

Forty years ago the "frosty Caucasus" was practically unknown to the physical geographers and naturalists of Western Europe. Before 1870 some light was thrown on its heights and recesses by the researches of the eminent botanist, Dr. Radde, and the wanderings of English mountaineers. It was discovered that there were other lofty summits in the range besides Elbruz and Kazbek, and that these were not even typical summits, but volcanic excrescences from a chain composed largely of crystalline rocks. The snow-girt basin of Suanetia, the Alsatia of the Caucasus, was penetrated, and the twin peaks of Ushba added to the known glories of the world.

English readers are, or ought to be by this time, familiar with the natural features of the Central Caucasus. Its scenery has been often described by Alpine Clubmen, and depicted by the masterly hand of Signor Vittorio Sella. Of the western and eastern flanks of the range, of Circassia and Daghestan, we know less in this country. The German public, however, has had presented to it, in the two very substantial volumes and 2000 pages of Herr Merzbacher, a detailed account of travel in the eastern as well as in the central districts. M. de Déchy, who, though a Hungarian, writes in German, now attempts to combine, for the first time in a single work, a description of all the three main sections of the Caucasian

chain. The first two volumes are complete in themselves, while the third is, as we shall show presently, more particularly addressed to specialists.

M. de Déchy has good qualifications for the task. A practised mountaineer and an expert photographer, he has paid seven separate summer visits to the Caucasus, travelling, climbing, and photographing in the company of alpine guides, and at times with scientific specialists. He presents the results of his journeys in the form of a personal narrative, into which are interwoven the topographical and ethnological observations made on the road. His sentences are agreeably short, and he writes in a style livelier and less laborious than that to which we are accustomed in German-written works. He has a good eye for scenery and picturesque incident, and is at pains to point out the different characteristics of the various regions traversed. He by no means neglects the human element, and in the Caucasus mankind offers a very large field for study. His work, as a whole, supplies, in a most readable and not too lengthy form, an adequate general picture of the structure, physical features, and inhabitants of the mountain region, and of the frequent incidents of travel in a country where few days are without incidents, often of a kind pleasantest in memory. For in many parts of the Caucasus the daily difficulties, whether caused by the absence of tracks or the perverseness of the inhabitants, are apt to make most African or Asiatic travel seem in comparison a simple affair.

It is in the descriptions of the western and eastern sections of the chain that English readers will find most novelty. The Caucasian snows extend at least 150 miles beyond Elbruz. West of the great volcano the Klukhor pass affords a more or less practicable horse-road across the chain—a road frequented in classical times, and now restored by the Russians. M. de Déchy suggests (vol. 2, p. 159) that it may be inferred, from the fact of its having been used 2000 years ago as a trade-route, that there was less snow on the Caucasus then than now. We do not think this follows. Strabo particularly mentions that the natives, when they came over from the north to Dioskurias (Sukhum Kaleh), used toboggans and snow-shoes. Beyond the Klukhor, extending 35 miles to the Marukh pass, extends the Klukhor group, the glaciers of which may be seen, a shining shield, from the Black Sea. Their reservoirs are extensive, and they descend on both flanks between bold rock pinnacles into valleys filled with noble forests. An account of climbing and exploration in this district has been recently given in the *Alpine Journal* by Dr. Fischer, whose brother perished with Donkin and Fox on Koshtantau. Its largest glacier, the Amenaus, has an extent of 16 square kilomètres, and descends to 5874 feet. Its highest summit, Dombai-Ulgen, reaches 13,250 feet.

To the next section, the last to carry snow and ice, M. de Déchy gives the appropriate name of the Abkhasian Alps, a memorial to a vanished, or rather banished, race. Its limits he defines as the Marukh and Pseka passes; the distance between them is not far short of 100 miles. Its highest summit, Psyrs, is 12,429 feet. On the south side of the chain, from Suanetia westwards, the range of Palæozoic slates, which culminates in the Leila group, runs more or less parallel to the crystalline axis, and encloses the long parallel trenches of the Ingur, the Azgara, the Bsyb, and the Msympta. Of one of its culminating clusters, the Chedym group, M. de Déchy furnishes some fascinating pictures. It bears several secondary glaciers, and others lie scattered in the recesses and hollows of the main chain. Only one or two, however, descend on the north slope as far as 6200 feet, and cannot be called of the first order. The last ice seems to be found on the Fisht and Oshten peaks in 40° E. long.

Of this interesting region little has been heard since the visits more than fifty years ago of Mr. Spencer and one or two other sympathizers with the native tribes.

M. de Déchy has broken fresh ground in it by his passage across the chain from the headwaters of the Great Laba to those of the Bsyb. But right and left of his route there is work for many explorers and climbers, and we may add map-makers. For it is obvious, as the author himself suggests, in the *Errata* to vol. 3, that the indications of glaciers in his map are in this neighbourhood uncertain and inadequate. The task will not be altogether easy, for, owing to the depopulation of the valleys on the southern flank, travellers must carry with them full provisions for their sojourn in the mountains. But the adventure will bring ample reward to lovers of forest scenery, botanists, and probably sportsmen, though the last-named must be careful not to trespass on preserves, where the auroch still lingers under grand-ducal protection.

East of the Dariel road M. de Déchy's travels and ascents have been more extensive and numerous than in the western region. His first journey led him among the network of valleys and ridges to the north-west of Daghestan, the country of the Tush and Chevsur tribes. Crossing many passes, he explored the glaciers of the Pirikitelian group and climbed its highest summit, Datach-kort, 14,016 feet. In further journeys he visited the home of Schamyl, and wandered through the valley of the Andischer Koisu and across the flanks of the Bogos group, finally crossing to Telaw in the Georgian lowlands. An ascent of the volcanic heights of Basardjusi completed the author's travels in the Eastern Caucasus.

Had we to divide the Caucasus into two in place of three sections, we might make the Mamisson, not the Dariel, the point of separation. For the Kasbek group belongs rather to the eastern type. The contrast between the scenery of the eastern and western Caucasus is well brought out by the illustrations. It is the contrast between sharp granite peaks and icefalls tumbling towards or into luxuriant forests and flowery dales, and landscapes our ancestors would have called "horrid," slaty roof-like ridges, naked scarred hillsides, and barren glens and gorges. But in Daghestan man makes some amends for nature's shortcomings. The villages are striking in themselves, and still more so in their situation: witness the very romantic view of "Tindi," cut off from the world by its grim fence of sky-reaching summits. And the inhabitants are worthy of their homes—at any rate, from the ethnologist's and photographer's point of view.

It is impossible in the limits of a review to enter in any detail into M. de Déchy's routes, or to do justice to his extensive travels in the central districts on both sides of the chain between Suanetia and the Dariel; nor is this the place to dwell on his climbs, which included, in the Central Caucasus, Elbruz and Kasbek, a peak he identifies with the highest summit of the Adai Khokh group, and many glacier passes. Nor can we attempt here to do more than call attention to the geological details and diagrams frequently interspersed in the narrative.

One criticism we are disposed to make. We regret that the author has not arranged his chapters with respect for locality rather than for date, particularly in his second volume. It is somewhat distracting for a reader to find himself carried backwards and forwards between the very alluring and romantic forests and glaciers of the almost uninhabited region west of Elbruz, and the stern heights, water-worn slopes, grim gorges, and strange villages of Daghestan. The eastern groups seem generally to arrange themselves more in ridges than isolated peaks, and Basardjusi is a positively ugly summit. It is to the valleys behind Sukhum Kaleh that the botanist, the climber, and the lover of the picturesque will turn most eagerly. Here surely lies one of the future playgrounds of Europe.

M. de Déchy's text is amply and luxuriously illustrated, both with views of the mountains and portraits of their very various inhabitants. These illustrations are for the most part of extraordinary beauty, and it is hardly possible to praise them

too highly. The subjects have been, as a rule, well chosen, and the figures often most skilfully grouped. They have all the merits of photographs without the defects commonly found when photographs are reproduced for book illustration. On the one hand, few or none, even of the plates in the text, are black or blurred; on the other, the hand of the "improver" has not interfered with or obscured local detail and characteristics. They afford good material for a discourse on how to treat photographic material, a discourse which might be made more effective by contrast. For not a few of the photographs used by M. de Déchy, whether his own or those of others, had previously served in 'The Exploration of the Caucasus' or in Herr Merzbacher's book, and several in both. In the former work some even of the heliogravures are flat (contrast the same view opposite p. 142, vol. 1, of 'The Exploration' and opposite p. 27, vol. 1, of Déchy), while the process plates in the text often lack the clearness and brightness M. de Déchy has attained. Herr Merzbacher employed artists and woodcutters to deal with his material. The result is, as a rule, a relatively faint, unimpressive picture, in which the peculiar local type of the landscape is apt to be modified by subjective influences. What, then, is the secret of M. de Déchy's exceptional success? We believe it to lie in the very skilful retouching of the plates, especially with regard to the foregrounds, under the close supervision of the author. A few slips in the identifications of the peaks illustrated may be pointed out. In the Panorama, vol. 1, p. 88, of the Mishirgi glacier, "Dych-Tau-Grat" should be Mishirgi Tau, "Midschirgi Tau" Ulluauz Bashi, and "Ulluauz Bashi" Ukiu. The view from the Tuiber pass on p. 222 is looking east, not "west." Writing in German, M. de Déchy naturally adopts the German method of spelling, which allows such monstrosities as Schchara and Schchelde, and doubles S at the beginning of a word.

The map, in two sheets, on the scale of 1 : 400,000, based mainly on the Russian Surveys, is valuable as giving a complete picture of the chain from sea to sea. Partly, however, owing to the comparatively small scale, the delineation of the glacial region is generally wanting in detail and distinctness. For the same reason, M. de Déchy has been unable to emphasize some called-for corrections in the new Russian survey in the chain south and east of Elbruz.

We regret the absence of one or two good district maps, for example of Elbruz and the Central Group. They would have had interest for students as well as travellers.

The third volume contains the scientific results of the travels of M. de Déchy and his companions. His geological and botanical collections, the latter comprising several new species, are illustrated and described by various specialists. The remaining space is occupied by a more general disquisition on the structure and glacial features of the Caucasus by the author. This is done in a masterly manner without undue detail, and should be of the greatest use to future encyclopædists. M. de Déchy gives a careful account of the orography of the chain from sea to sea, dividing it into groups or sections. He reviews, as had previously been done in this country, the long struggle which active explorers had to wage with bookmen in order to induce them to abandon their preconceived ideas of the small extent of the Caucasian snowfields and ice-streams.

The recent oscillations in the glaciers and their probable extent during the ice period, are both referred to. The absence of sub-mountainous lakes and the rarity of high tarns are noted, and the explanations furnished by Prof. Penck and his followers of these facts put forward. This is hardly the place to enter into the protracted argument as to the probable origin of lake-basins which still occupies and divides geologists. Sufficient weight has hardly been given hitherto to the action of torrents, both in filling up and in tapping natural hollows. They may

be studied at work to advantage both in the Maritime Alps and the Adamello group. Our own experience, which is fairly extensive, leads to conclusions similar to those of Prof. Heim, Prof. Bonney, and Prof. Garwood.

Taken as a whole, these volumes offer to the public a very complete picture of the characteristics of one of the most interesting portions of the Old World. M. de Déchy may be congratulated on the skill with which he has succeeded in combining the materials collected by his predecessors, of which he has made free and frequent use, with his own observations, and presenting them to the public in a form likely to be attractive to the general reader, as well as valuable to the scientific student or mountaineer.

D. W. F.

Burma.

'Burma: a Handbook of Practical, Commercial, and Political Information.' By Sir George Scott, K.C.I.E., with special articles by recognized authorities on Burma. London: The De La More Press. 1906. *Price* 10*s*. 6*d*. *net*.

The heading to this book might lead one to conclude that the contents consist mostly of dry unpalatable matter, but the reader will be disillusioned, and speedily find himself on the best of terms with the writer. Those who have read 'The Burman, his Life and Notions,' by Shway Yoe (the pseudonym used by the present writer in his earlier days), will readily recognize and appreciate the same characteristic charm and pleasant humour of style throughout this work. People who have resided in Burma, and know something of the country and its inhabitants, will find much herein to amplify their knowledge, whilst those who contemplate a first visit to Burma can accept with confidence the information recorded in these pages, in preference to being misled by the "emotional and sketchy" authors on this subject, referred to in the preface of this work.

In his unpretentious way, the author describes his book as "of the nature of a skeleton, or of a painter's study for a large work," but there is much herein which savours of careful study and thought, and it is to be hoped that the same hand will, at some future date, undertake to write the larger work, when the cessation of administrative labour affords the requisite leisure.

Burma is a land of much promise and many possibilities, and although much has been effected by the administration since its annexation, the country is still in the infancy of its development, and no one who has lived there can deny that there is a great future ahead. There are still vast areas beyond the northern administrative line about which we still possess very little knowledge, and when railways are extended beyond Mogaung and Myitkyina, it is possible that at some distant date a veritable Klondike may be discovered far away in the Nam Kiu (or, more correctly speaking, the Loi Nok Ngeun) mountains.

There are untold attractions for the traveller, geographer, prospector, capitalist, artist, archæologist, and ethnologist, to whom this modest volume will appeal, and serve as a useful and valuable guide and *vade mecum*. As the forests of India become denuded of game, the sportsman too will hie to pastures new, and when the art of shooting from howdahs, as hitherto practised in the Indian terais, is better understood in Burma, there will be no lack of the very best sport in the Shweli and upper Irrawaddy valley areas, for has not every Chingpaw a row of tiger's teeth to adorn his sword-belt? let alone the evidence of numerous tracks of wild animals which one encounters along every footpath in these forests; whilst at the confluence of the Nmai Hka and Mali Hka, the fisherman can revel in perhaps the finest mahsir-fishing in the world.

In Burma there lies a vast and fascinating field of research for the ethnologist

and philologist, and this book is one of the pioneer attempts to unravel some of the knotty problems involved, to classify the different races, and trace their origins, affinities, and migrations. The pages are replete with excellent illustrations of the numerous tribes encountered in Burma. One of the most curious races are the Padaungs, depicted in the frontispiece of this work. I happen to possess the accompanying photograph, which is perhaps a more pronounced and typical representa-

"PADAUNG" WOMAN AND CHILD, SOUTH SHAN STATES, BURMA.
(*Photo by H. D. Stolesburg.*)

tion of this grotesque tribe than those given in Sir George Scott's book, and which may be of general interest to the readers of the *Journal*.

A few years ago, at Lord Curzon's instigation, I believe, a grant was made for the purpose of restoring and preserving the late king's palace at Mandalay, and other buildings of special interest. There is a monastery, vulgarly known as the snake *kyaung*, the correct Burmese name of which I have forgotten, but it has nothing whatever to do with a snake. It is situated amongst a labyrinth of *kyaungs* to the left-hand side of the south moat road or main street leading from the palace to the Irrawaddy river, and about 50 yards away from the road. It is certainly one of the best and most strikingly beautiful specimens of wood-carving to

be found in Burma. The style is quite unique, and I have never seen anything to resemble it elsewhere in the country. During my last visit to Mandalay some three years ago, it was found that this *kyaung* had not been included in the list of buildings for preservation, for it was evidently suffering from neglect, and courting the inexorable fate of all wooden buildings. I trust this may catch the eye of some one in authority, and be the means of saving a most beautiful piece of work.

Where nothing but praise is due, the author, I feel sure, will pardon (for it is no fault of his) my cavilling at the map provided. It is at best a skeleton map, whilst the few names to be found therein are hardly decipherable even with the aid of a magnifying-glass. The binding, moreover, is not a credit to the publishers, for some of the numerous illustrations begin to show signs of dropping out with very slight provocation.

J. R. HOBDAY.

AUSTRALASIA AND PACIFIC ISLANDS.

WEST PACIFIC ETHNOLOGY.

'The Savage South Seas.' Painted by Norman H. Hardy, described by E. Way Elkington. London: A. & C. Black. 1907. *Price* 20*s*. 211 pp., 68 *coloured plates*.

Mr. Norman Hardy has travelled a great deal in the West Pacific, and been in many out-of-the-way places, and now he presents us with numerous coloured pictures illustrating the scenery and domestic life of the natives of various parts of Melanesia. It is a comfort to come across an artist who is keen on ethnology, and accurate in his details. The student who knows the district may study the plates without being annoyed by errors of decoration, costume, house-construction, and so forth, and the non-expert may feel assured that he is not being misled. The present writer has no criticism to make concerning the drawing, but the colouring does not always seem to him to be quite happy. The skin-colouring of the natives, more particularly of the Papuans, is usually too yellow or too cold, and in many cases the hair is distinctly bluish, whereas it is brownish, when it is not dead black. The value of the illustrations would have been increased if a full description had been added to each plate, as there are many details of interest which will escape most people; for example, in certain plates, such as 10, 12, 59, the pale colour of the shallow water on the top of the fringing reef, and the intense colour of the deep water beyond are clearly indicated, and the same applies to ornaments and objects depicted, but not described, or if they are described no reference is made to the plate, or from the plate to the page. Mr. Elkington apparently has not visited the places he describes; indeed, except when the information was obviously obtained from Mr. Hardy, it is generally possible to tell from what source the information was derived. There are not a few inaccuracies; for instance, to mention but three: John Williams did not do any missionary work in New Guinea (p. 197); nose-sticks are never made of "ivory" (p. 173); the account of pottery-making in New Guinea is not quite accurate (62). In a large area like British New Guinea there is great local diversity in native manufactures and customs, but Mr. Elkington constantly writes as if certain customs are universal; indeed, there is an almost total lack of precision in his remarks. There are also misprints that should not have been passed over: on p. 49 we read "In the Mekko district, south-east of Port Moresby, most elaborate masks," etc. He probably meant to say, "In the Mekeo district, north-west of Port Moresby," etc. In more than one place "tredacua" is given for "tridacna." The plates, after all, are the sole feature of the book, and they will prove very useful to teachers in illustrating the conditions of life in Melanesia.

A. C. HADDON.

GENERAL

EARLY TRAVEL

'Hakluytus Posthumus, or Purchas His Pilgrimes.' By Samuel Purchas, B.D. 20 vols. Glasgow, 1905-07. Price £12 10s. net.

'Coryat's Crudities.' 2 vols. Glasgow, 1905. Price 25s. net.

'The History of Japan, together with a description of the Kingdom of Siam, 1690-92.' By Engelbert Kaempfer, M.D. 3 vols. Glasgow, 1906. Price 37s. 6d. net.

'The Rare Adventures and Painefull Peregrinations of . . . William Lithgow.' Glasgow, 1906. Price 12s. 6d. net.

'The Generall Historie of Virginia . . . Together with The True Travels . . .' By Captaine John Smith. 2 vols. Glasgow, 1907. Price 25s. net.

Encouraged by the success of their reprint of 'The Principal Navigations,' Messrs. MacLehose have undertaken, and have now brought to a conclusion, the yet heavier task of reproducing in like manner the similarly named collection by which the Rev. Samuel Purchas sought to continue (and in some measure to supersede) the work of his friend and master, Richard Hakluyt. The venture was a bold one, for the continuation is not only far more voluminous but less popular than the original work, and the publishers are to be congratulated on their public-spirited action. To those who love the literature of the ancient voyages the reprint will be a great boon, for the original has long been at a high price, and even when obtained is often imperfect, especially as regards the engraved title-page and the maps. We now have, in handy form, a reprint of the text, facsimiles of all the illustrations (with the addition of some fresh ones), a short but excellent life of Purchas, and a general index. There has been a slight (and quite justifiable) modernization of the spelling and punctuation, and obvious misprints have been corrected; but otherwise the text has been faithfully reproduced. Of the beauty of the printing, and the admirable way in which the illustrations have been executed, nothing need be said, as Messrs. Maclehose's abilities in this direction are well known; and the only criticism we have to make is that the list of plates might with advantage have discriminated between those which belong to the original work and those which have been supplied from other sources (which should have been specified). The index—a most valuable feature—is full and, so far as we have tested it, accurate, though we could have wished for more cross-references, especially as regards the modern equivalents of Purchas's quaint spellings. Thus it may not occur to a reader to look for references to the Emperor Jahangir under "Selim Ohe-hangier Shah;" to Varthema under "Barthema" or "Vertomannus;" to Tabriz under "Tauris;" to Afghans under "Agwans;" or to the Persian general Ali Vardi Beg under "Oliver-Dibeague." We notice, also, cases in which two men of the same name have been confused, or one man appears in two places under different spellings. All this suggests a doubt whether the publishers were wise in resolving to do without an editor. To annotate the work fully would of course have swollen it to an undesirable extent; but we cannot help thinking that a few notes—particularly references to books in which the various narratives have been republished with elucidations, or to the present location of the original manuscript (when this is known)--would have been a great gain. However, it is perhaps captious to complain that the work is not something more than it professes to be; and we have already abundant cause to be grateful to Messrs. Maclehose for this very acceptable reprint.

Of the other volumes in the series it is unnecessary to say much. They are all rare and interesting narratives, and they have been reproduced with the same care and in the same excellent style as Hakluyt and Purchas. We could wish that Coryat's entertaining account of his European travels had been rounded off by the

inclusion of his letters describing his last journey, which took him to the court of the Great Mogul, and finally laid his rambling brains to rest in an unknown grave near Surat. Kaempfer's 'History of Japan,' as translated by Scheuchzer, is welcome as a work of great importance which has never been reprinted in its entirety since its first appearance. The present edition contains a note on the Scheuchzer family by Sir Archibald Geikie, and (in an appendix) a narrative of the attempt of the English East India Company to reopen commerce with Japan in 1673. The choice of Lithgow's narrative was perhaps influenced by the publishers' patriotism, but we are glad to have his spirited account of his journeyings in the Levant and Northern Africa, and his sufferings in Spain. The last work of all is particularly opportune in relation to the recent festivities at Jamestown.

W. F.

SHORT NOTICES.

Europe.—'The Itinerary of John Leland.' Parts i. to iii. Edited by Lucy Toulmin Smith. (London: George Bell. 1907. Pp. xlv. and 352. *Maps and Frontispiece.*) This is the edition of Leland originally undertaken by Mr. G. L. Gomme. It has been thus far excellently carried out; a full biographical preface is given, and the indices of persons and places are very valuable. The maps, also, show Leland's routes as satisfactorily as possible. The frontispiece represents a bust, now lost, of the antiquary.

'The Land in the Mountains.' By W. A. Baillie-Grohman. (London: Simpkin Marshall. 1907. Pp. 31 and 288. *Maps and Illustrations.*) This book deals with the Tirol, on which the author writes, as he has before, with intimate authority. This time he deals mainly with the history of the country, in connection especially with some of its famous old castles—that of Matzen, which has come into his own family, figuring prominently. The book is full of interesting reading, and the illustrations are beautiful; the maps waste a good deal of space.

'A Handbook of Cyprus,' by Sir J. T. Hutchinson and C. D. Cobham, C.M.G. (London: Stanford. 1907. Pp. xii. and 132. *Maps and Frontispiece*), is the fifth reissue of what may be termed the beau ideal of a handbook. Within its small compass is crystallized authoritative information on the island in every aspect, from geography, geology, flora, fauna, history, to population, administration, and trade. It would be well if so excellent a work of reference existed for every unit of the empire.

Asia.—'Prjevalsky's Horse,' by W. Salensky (London: Hurst & Blackett. 1907. Pp. xvi. and 65. *Illustrations*), deals with the wild horse discovered by the Russian traveller Prjevalsky in the Desert of Gobi. There is an introduction by Prof. Ewart of Edinburgh, in which this type of horse is indicated as one of the ancestors of various important and well-known breeds.

'The Chinese Empire. A General and Missionary Survey.' Edited by Marshall Broomhill. (London: Morgan and Scott. [*n.d.*] Pp. xxiv. and 472. *Map and Illustrations.*) This is in the main a missionary survey, in which members of the China Inland Mission deal individually with provinces known to them. Each province, however, is also the subject of a short geographical survey, which widens the interest of the work. We learn from the preface that it was intended to issue simultaneously an atlas of the Chinese Empire. Some delay has arisen over the latter in connection with the transliteration of names, as that used by the Chinese Post Office, which it is intended to adopt, is undergoing revision; it was therefore decided to issue the book to prepare the way for the atlas, which is promised shortly, and will be awaited with interest.

THE MONTHLY RECORD.

EUROPE.

The History of Steam Navigation on the Lake of Constance is told in an interesting article by Dr. Halbfass in the *Deutsche Rundschau für Géographie* (vol. 29, No. 8), based on a two-volume work on the subject by F. Pernwerth von Bärnstein. One of the busiest lakes in the ancient world as regards traffic, the Lake of Constance, more particularly the towns of Constance and Lindau (known as the "Swabian Venice"), carried on in the Middle Ages a lively transit trade in Levant goods. Flourishing in the fourteenth and fifteenth centuries, and culminating at the beginning of the sixteenth, this trade almost entirely disappeared in the following centuries. The modern revival of trade on the lake dates from the beginning of steam-shipping. The cradle of the revival was Friedrichshafen (formed in 1811, out of Buchhorn and Hafen), where, December 1, 1824, the ship *Wilhelm* began to ply regularly to and from Rorschach, and where, October 24, 1847, was opened the railway from Friedrichshafen to Ravensburg, the first railway to reach the lake. Simultaneously with the *Wilhelm*, the *Max Joseph* was launched, but being driven by competition to Baden ports, it soon ceased running. In 1830 a Constance steam shipping company ran two vessels along the whole course of the lake and the Rhine as far as Schaffhausen. In 1854 the Wurtemberg steam-shipping business was transformed into a State establishment, worked in conjunction with the State railways, which had for some time reached to the lake. Gradually the steam-traffic of the lake became transformed into an auxiliary of the railways. In 1865 a Schaffhausen steamboat company established a service for the Untersee and Rhine as far as Schaffhausen. In 1869 Scott Russell built a railway steam ferry-boat to carry sixteen goods waggons across from Friedrichshafen to Romanshorn, and four years later was opened the steam ferry service, Lindau to Romanshorn. A new section was added to the trade of the lake by the introduction, in 1884, of Austrian shipping, following on the building of the Arlberg railway, which joined the Vorarlberg railway with the other lines of the empire. Gradually the lake flotilla increased to thirty-two steamers. For the future development of the trade of the lake, the writer hopes much from the extension of European inland navigation. By the establishment of a "Rhein-Grosswasser" system—connecting Constance lake with Rotterdam *viâ* Basel, and ultimately uniting the Danube with the Rhone *viâ* the lake—the latter would be placed in communication with the Black sea and the Mediterranean, and become for the adjacent states all that the Mediterranean is for the states round its shores.

Disaster to a Scientific Traveller in Iceland.—We learn from the ninth number of *Petermanns Mitteilungen* that a disaster appears to have overtaken a German scientific traveller in Iceland, Dr. Walther von Knebel, who is known for his studies of volcanic phenomena, and who, in company with Dr. Spethmann, had undertaken the examination of the great lava-field of the Odadahraun, north of the Vatna Jökull, partly explored by Thoroddsen in 1884. He is said to have ventured in a portable boat on the hot lake of the Askja volcano, accompanied by a young artist named Rudloff. The circumstances of the disaster are not known, but as the remains of the boat were found on the shore, with no trace of the travellers, there seems little hope of their safety. A short sketch of Dr. von Knebel's career is given in *Globus*, vol. 92, No. 8. He had shown promise as an original observer, and had undertaken journeys of research in various parts of Central Europe, including the Karst region of Istria, as well as further afield, in the Canaries and Iceland, to the latter of which he had made a first journey in 1905.

ASIA.

Dr. Tafel's Journey in Eastern Tibet.—This traveller, whose persistent efforts to make his way into Northern Tibet from the neighbourhood of Kuku-nor have frequently been referred to in the *Journal* (vol. **28**, pp. 398, 506; vol. **29**, p. 224), has at last succeeded in his enterprise, though with some curtailment of his original plans. Further communications (printed in *Petermanns Mitteilungen*, No. 8, 1907) have been received from him in Germany, the last of which announces his arrival in Ta-tsien-lu early in May. An earlier letter had been sent off in February from Jekundo (evidently the Kegudo of A—K, Jyekundo of Rockhill, Gyerkoundo of Grenard), to which he had made his way from Sining-fu by a route which coincided as far as the upper Hwang-ho with that of himself and Lieut. Filchner in 1904, and beyond that river cannot have diverged widely from that of Grenard, though in the opposite direction. On the Hwang-ho he came across the great Golok tribe of the Hokurma, who were not particularly friendly, but by joining the caravan of the "Behu" or chief of Chendu, he was able to overcome difficulties. Before reaching Chendu (? the Chinto of Grenard) he crossed, by a pass with an easy ascent from the north, into a totally new kind of country, having left behind the monotonous plains with slightly sunk valleys, and entered a region of accentuated relief and great scenic beauty. During the journey from north to south the amount of snow had steadily increased, and on the passes near Jekundo reached a depth of almost a foot. The valley of the Yang-tse followed a south-easterly direction, which is that of the general strike of the mountain ranges and geological formations. About Tom-bum-da (Tong-bou-mdo of Grenard), the place of the murder of Dutreuil de Rhins, the scenery was particularly fine, and would be striking even in Switzerland. The valley of the Yang-tse has no counterpart among the Swiss valleys. The river is the size of the Rhine above the Lake of Constance, but while the valley-floor is only a quarter of a mile wide, the slopes on either hand rise to heights of over 3000 feet, at an average angle of some 40°. The river flowed quietly, and was of a clear green colour, unobstructed by rocks. Dr. Tafel had entertained hopes of continuing his way south to the bend of the Sanpo, crossing the mountains to Shimong (near the river's exit into the plains of Upper Assam), and proceeding by the Tila-la in the direction of Sechuan. But this plan failed owing to the refusal of his men to go in that direction, and he was therefore compelled, like Rockhill and A—K, to take the route to the south-east. He passed through a famine-stricken district, and met with some opposition, but was able to proceed with the support of a Chinese official, reaching Ta-tsien-lu with fourteen animals out of the twenty-four with which he had left Sining-fu.

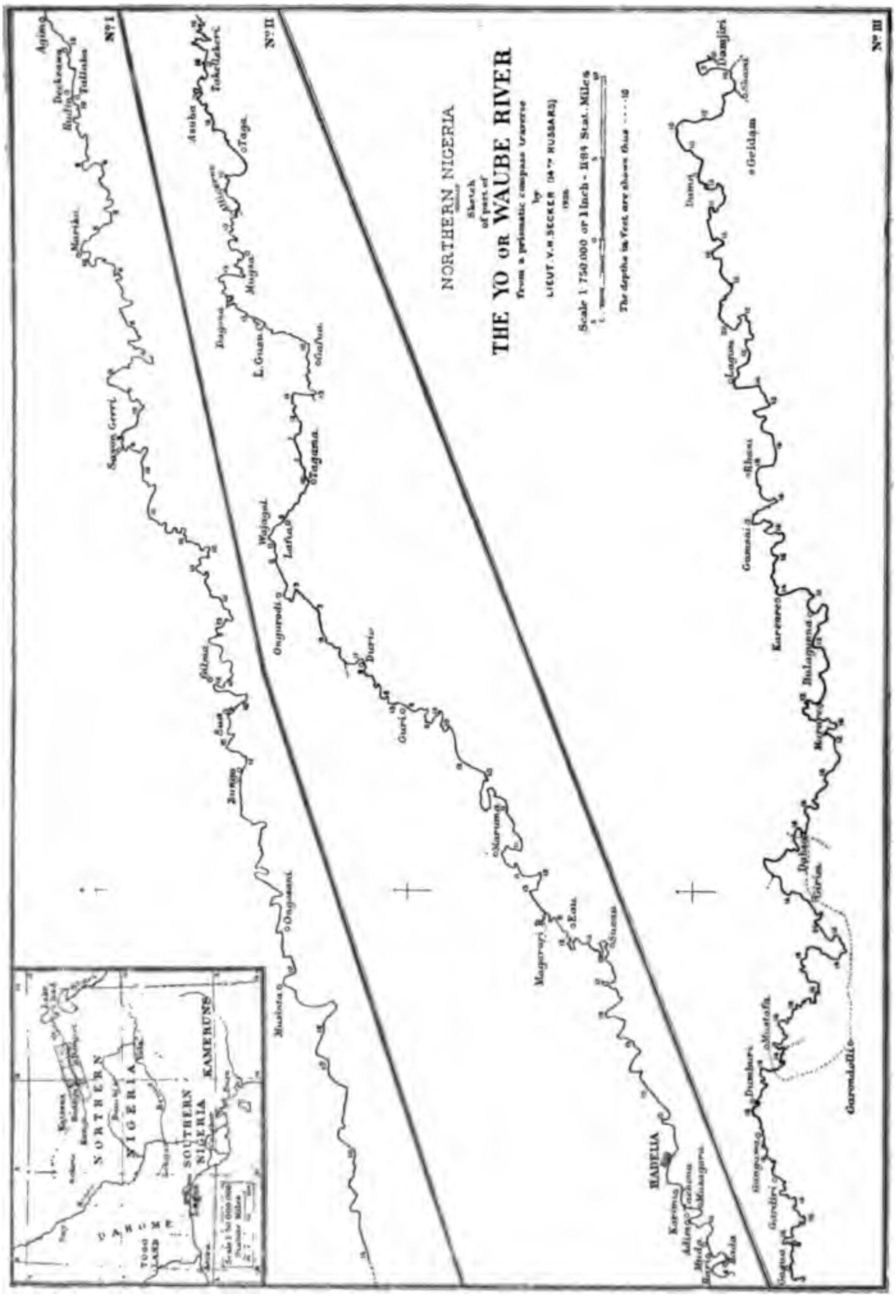
Captain D'Ollone in Western China.—The July number of *La Géographie* prints information from this traveller (*Journal*, vol. **29**, p. 222), stating that he had traversed successfully the country of the independent Lolos, properly known as Ta Liang Shan. It is claimed that this is the first time that a European has succeeded in crossing this country in its entirety, though it will be remembered that so far back as thirty years ago a complete circuit of its borders were made by Mr. Colborne Baber, who brought back much interesting information on the Lolos, while its fringes have been touched by many recent travellers, including the Comte de Vaulserre. The district lies to the north-west of the upper Yang-tse, in about 103° E. long.

Kozloff's New Expedition.—The well-known Russian traveller Kozloff has, we learn from *Petermanns Mitteilungen*, just started on a new expedition to Central Asia. He will proceed to Kuku-nor by way of Kiakhta and the Ordos country, and intends to establish a geodetic station on an island in the lake. Afterwards he proposes to continue his former explorations by a journey through Eastern Tibet to Western China.

The Geyser of Atami, Japan: Periodicity of Eruption.—The question of the periodicity of the eruption of geysers, though long the subject of study, has never been thoroughly cleared up. A striking example of a geyser with a remarkably regular period is that of Atami, situated on the eastern slope of the coast range of Izu, Japan, the phenomena of which have lately been investigated by Messrs. Honda and Terada, lecturers in the Tokyo Imperial University (Publ. Earthquake Investigation Committee, No. 22 B, Art. 4, 1906). In this case there are alternate projections of hot water and steam, usually five times in fairly rapid succession, while the whole composite eruption is, under ordinary circumstances, repeated five times in a day and night. Records were obtained of the mode of succession of the phases by an ingeniously contrived self-registering apparatus, and these are reproduced with the paper. They show in a striking way the various series of "intermittences," as the repetitions of individual phenomena are termed by the writers, which make up one eruption. The apparatus was so arranged as to record separately the outflows of water and steam, and the diagrams, when so superposed as to bring their abscissæ (representing time) into coincidence, show clearly the regular alternation of the two phenomena. Besides the ordinary eruptions, there is an abnormal outburst known as *nagawaki*, in which the water and steam come out incessantly for about twelve hours. In years most noticeable for this anomaly, it has occurred almost monthly, though the automatic records kept continuously from 1904 to the date of writing only revealed four. These all began, suddenly, at the same phase of an ordinary eruption, and a centre of low atmospheric pressure was approaching from the Pacific in each case. A great decrease in activity was noted in 1904, obviously as a result of the boring of new wells in the neighbourhood, and the frequency again increased with the stopping of some of these. Existing theories being insufficient to explain the exact manner of the eruption, the writers experimented with models formed of tanks and pipes, and at last succeeded in satisfactorily reproducing the phenomena. The result points to the following as the most probable explanation: The water is heated in an underground cavity connected with the vertical pipe of the geyser by a canal, which is also connected (by a side canal) with a second cavity, in which the water is at a lower temperature. After the pressure in the first cavity is temporarily reduced by an eruption, the colder water flows in from the side canal and momentarily stops it, this being repeated until enough cold water has been admitted to entirely quench the activity for a time.

AFRICA.

The River Yo from Damjiri to Hadeija and Kano.—The accompanying sketch-map is reduced from a survey by Lieut. H. Secker, who sends us the following notes respecting the hydrography of the river in the portion in question. "When I started from Damjiri on November 24, 1906, the river was full and at its highest. The velocity of the currents was nowhere more than 1 mile per hour between that place and Kano, and was nowhere so strong as to prevent a canoe being paddled against it. On reaching Hadeija the river was commencing to fall, and consequently from that town to Kano the current was not nearly so strong, *i.e.* sluggish, also poles could be made use of, which made progress a great deal faster, and in favourable reaches the sail was of great assistance, but would have been more so if of larger dimensions. Soundings were frequently taken, and are marked on the sketch. The river varied considerably in width between Damjiri and Hadeija, and in many places the banks were under water. Aneroid readings were taken early each morning, but owing to the variability of the temperature at this time of the year they are not to be trusted, and I have not included them in the sketch. The bed of the river is entirely free from rocks, and only in a few



places are there to be found stumps of trees of any great size, and they are easily located. After the river has been properly cleared and deepened, I believe it would be quite practicable for a steam canoe to go from Damjiri to Kano when the river

is at its full height. I consider the Yo river could be easily made navigable by the expenditure of a certain amount of labour, devoted to clearing and widening its course across marshes, and deepening it in places, which could easily be done owing to the nature of its bed at these spots. I consider the fact that the river is in places blocked by weeds, and in others gradually silting up, is due to the native practice of erecting fish-dams completely across the stream, which have the effect of damming the flow by collecting a large amount of weed, etc., and they also divert the true course of the stream, causing the water to overflow and form large marshes. Also log bridges are used, which also collect weed as above stated. I believe the above has a great deal to do with the receding of the water in Lake Chad, and if it is the general custom to use these fish-dams in other rivers which feed Lake Chad, an enormous quantity of water must be diverted. There is no reason why these dams should be used, for where the river is too deep for their erection by the natives, they make use of fish-traps, placed near the banks, which do not interfere with the flow of water to any extent, and this could also be done elsewhere. Poles could not be used practically the whole of the way from Damjiri to Hadeija, the depth being too great. Six canoe-men paddling against the stream are not enough to make fair progress with the description of canoe in use; but ten could be easily employed."

Captain Lenfant's Expedition.—Information of this traveller's movements (cf. *Journal*, vol. **28**, p. 401) down to March 20 of this year is given in the July number of *La Géographie*. At the date mentioned he was, with most of the *personnel* of his expedition, at Laï, on the Logone. He expressed an opinion adverse to the land route from the Congo to the Shari, which necessitates a transit of sixty days through a difficult country, and suggested the utilization of the Bahr Sara from a point below the rapids to Fort Lamy. This would reduce the portage to nine days. Surveys and other studies of the region between the Sanga, Logone and Shari were being carried out by the leader and his assistants. Somewhat later news, given in the *Dépêche Coloniale* of August 7, is to the effect that Captain Lenfant left Lai on April 15, and made his way to Carnot, on the Mambere branch of the Sanga, examining *en route* an important right-bank tributary of the Logone named Pende (partially explored earlier in the year by Captain Périquet), which is said to offer the best route yet discovered between the basins of the Congo and Lake Chad. It rises west of the Yade mountains, and flows for some distance east of north, before making a wide sweep to join the Logone under the name Bandul. It traverses a comparatively thin forest which does not approach within 50 to 100 yards of the stream.

The Okavango and the Former Lake Ngami.—We have been favoured by the Colonial Office with extracts from two reports by Mr. Ralph Williams, resident commissioner of the Bechuanaland protectorate, on journeys made by him in the north-western part of the protectorate. One of these deals with the *régime* of the lower Okavango and its relations with the basin once filled by Lake Ngami, but which, as is well known, has been for some years virtually a dry expanse of reeds. The various branches of the river are described at some length, as Mr. Williams says that current ideas regarding the hydrography of the region are very faulty. But he describes the river system in a way which agrees generally with Passarge's account (to which he makes no reference), while, apart from the loss of water in the old lake-basin, even Dr. Livingstone's original account at the time of the first discovery of Ngami is in the main fully substantiated. Mr. Williams speaks of the Okavango as "a vast river rivalling if not exceeding in volume the joint waters of the Chobe and Zambezi at the Victoria falls," a description which, it may be supposed, is applicable only to a very limited period of the year. He thinks that the bed of the marshes into which the river spreads

must be fairly hard, as a vast quantity of water emerges at various points south and east of them, though very little ever finds its way to the lake-bed. To the east the outlets are given as the Kuruman, Machabe, and Boro. All the water of the first, and a portion of that of the two last, enters the Mababe, which flows north-north-east, but does not, Mr. Williams says, form a waterway to the Chobe (Linyanti), as has sometimes been supposed. The greater part of the water of the Machabe and Boro forms the Tamalakan—the upper course of the Botletle. Mr. Williams lays stress on the fact that not a drop of water finds its way to the site of Ngami from the Tamalakan, but this was recognized by Passarge, while Livingstone, in whose time a shallow arm of Ngami ran north-east to the Tamalakan, expressly says ('Missionary Travels,' p. 67), that it had never been observed to flow either way, though he suggests that "if the lake ever becomes lower than the bed of the Zouga [Botletle], a little of the water of the Tamunak'le might flow into it instead of down the Zouga." This is exactly corroborated by Mr. Williams, who says that in the event of a big rise of waters, the channel connecting the Tamalakan with the site of the lake * forms "a backwater in the direction of" the latter. Apart from this, the only channel by which any water now finds its way to the lake-bed is the Gunere (apparently the Siroe or Home of Passarge's map), for the Taukhe, or Tioghe (spelt "Tlhaoge" in Mr. Williams's report), now never reaches it. Nothing is said as to the overflow from the Okavango to the Linyanti seen by Major Gibbons and Mr. Percy Reid, Mr. Williams's journeys having apparently not extended so far. On one of them he travelled from Tsau (south of the Okavango marshes) to the Victoria falls *viâ* the Mababe and Linyanti, and found the route quite practicable. It is therefore, he says, to be recommended as a means of access to the north-western part of the protectorate in preference to the difficult desert route from Palapye to the Botletle. We have also received a copy of some voluminous notes on the native history of the region, collected by Mr. J. Ellenberger from old people of the Batawana tribe.

AMERICA.

Researches in the South-West United States.—In the summer of last year Mr. D. W. Johnson made a trip through some of the less accessible parts of the Western United States, in New Mexico, Arizona, and Utah, with a view to securing data which might help to elucidate the physical history of the region. He has briefly sketched the results in the *Technology Quarterly* for December, 1906 (vol. 19, No. 4), and has favoured us with a reprint of the paper. One of the points studied was the origin of the volcanic buttes in the Mount Taylor district, New Mexico, made classic by the report of Major C. E. Dutton. This observer had described the buttes as possessing vertical columnar structure, but had considered them as volcanic necks—an interpretation which had been contested by some recent writers, who found a difficulty in supposing such necks to have been forced up through slightly disturbed sedimentary beds. Mr. Johnson's examination leads him to pronounce the buttes as undoubted volcanic necks. The more or less vertical columnar structure shown by many of them he ascribes to the columns having developed at right angles to the floor of the crater, which would act as the cooling surface for the upper portion of the neck. The necks are more or less cylindrical in shape, and have come up from unknown depths, without, in most cases, in the least disturbing the surrounding sediments. From the northern end of the Bradshaw mountains the party started with waggons across the deserts to the north, turning east and north-east to ascend the great Mogollon escarpment to the

* This backwater is said by Mr. Williams to be known as Komane, a name which appears in Passarge's map as that of a channel to the north-east of the Mababe flats.

plateau above. Hence they went to the San Francisco mountain (12,794 feet), an old volcano which shows distinct traces of former glaciation, especially in the form of a splendid cirque eroded into the very centre of the mountain. Even at the present day snow lies on the higher levels and in sheltered places until well into the summer. Hence the party descended rapidly into the Colorado cañon, where they were nearly prostrated by the intense heat. Studies made throughout the plateau region showed that the so-called period of basalt outflow is really divisible into five or six distinct periods, while Prof. Davis's observations regarding the recent revival of erosion in the grand cañon region were confirmed. The crossing of the desert between Lee's ferry on the Colorado and the Kaibab plateau to the west was a matter of difficulty, but valuable observations were made in the region, confirming the idea that the faults and folds of the plateau province are much older than the present Colorado river. Mr. Johnson hopes to publish the results of the trip in a series of papers and reports.

AUSTRALASIA AND OCEANIC ISLANDS.

Relics of Early Voyages to Western Australia.—The Adelaide *Register* of June 15, 1907, contains information of the discovery on Dirk Hartogs island of two posts, the history of which is connected with the earliest European voyages to the coast of Western Australia. The *Register* states that the posts are to be attributed to Dirk Hartogs (the first Dutch navigator to reach the western coast) and Vlamingh respectively; but though one at least of the posts was no doubt connected with the record of their voyages, the statement as it stands seems somewhat incorrect. It is also a mistake to say, as does the writer in the *Register*, that the original records were concerned "with the first authenticated landing of white men on any part of the coast of Australia," for, as has been shown by Prof. Heeres in his memoir on the Dutch voyages to that quarter of the globe, there are various references, in the journal of the voyage of Carstenszoon in 1623 to the Gulf of Carpentaria, to the previous voyage of the *Duifken* (1606), including the definite statement that at one of the points touched at the men of the *Duifken* had "made a landing" (*op. cit.*, p. 43). The facts regarding the records on Dirk Hartogs island may be briefly recapitulated. A tin plate, originally fixed to a post by that navigator, with an inscription recording his visit, was found by Vlamingh in 1697, and taken to Batavia, being replaced by another on which the original inscription was copied, and a further record of Vlamingh's own visit added. This was found in 1801, during the visit of Baudin's expedition in the *Géographe* and *Naturaliste*, by Captain Hamelin of the latter vessel. It was half covered with sand, and near it was part of an oaken post, to which it had apparently been once fixed. Captain Hamelin set up a new post, to which Vlamingh's inscription was fixed, and also left a record of his own visit on a plate set up in the north-east part of the island (Peron, 'Voyage de Decouvertes,' vol. 1, pp. 194, 195). On the visit of Lou[illegible]s de Freycinet (himself a member of Baudin's expedition) to the same spot in [illegible]818 during the voyage of the *Uranie* and *Physicienne*, Vlamingh's inscription [illegible] in turn removed, the navigator's intention being "de soustraire un docu[illegible]m historique précieux à une perte probable et prochaine" ('Voyage autour du M[illegible] Historique,' vol. 1, p. 482). It was handed over by him to the Académie [illegible] Inscriptions et Belles-lettres, but some uncertainty seems to prevail as t[illegible] ultimate fate. It will thus be seen that neither of the posts now found (o[illegible] which is said to be of Baltic pine) can with any probability be attributed to [illegible] Dutch voyagers, but one at least would seem to be that set up by Hamelin in [illegible] One of the posts contains a cluster of nails, reproducing the name King and [illegible] year 1822, this being the date of the visit of Captain Philip Parker King to [illegible]

locality, during his survey of the coasts of Western Australia. Captain King's narrative (vol. 2, p. 179) mentions the discovery of two posts on the north-west point of the island, and his name and the date would seem to have been affixed to one of them. Beneath, the name Roe is cut into the wood, and this evidently refers to Lieut. J. S. Roe, R.N., who was serving under King at the time, and (according to the *Register*) became Surveyor-General of Western Australia.

A Shipwreck on the Crozets.—Mr. J. H. Bull, well known in connection with whaling voyages to the Antarctic, especially that in which Mr. Borchgrevink took part in 1894–95, lately underwent the experience of shipwreck and detention for some weeks on the remote Crozet islands, in the southern Indian ocean. He described the voyage and the occurrences connected with it before the Victoria Branch of the Royal Geographical Society of Australasia in March last, and has favoured us with a copy of his lecture. The voyage was organized by Mr. Bull and a small number of friends for the purpose of whaling and sealing in southern waters, and the adventurers secured the small schooner *Catherine* for this object, one of their number, a young Norwegian seaman, Captain A. H. Ree, sailing as master. The plan was to try for sea-elephants at Kerguelen and neighbouring islands, and afterwards to extend operations to New Zealand waters and various South sea islands. The expedition left Norway on August 23, 1906, and, after touching at the Cape, steered for the Crozets, where the ship anchored in American bay, Possession island, on November 25. All went well till December 2, when the bad weather commenced which culminated in the total loss of the ship, the crew, however, landing in safety. A few of the stores were saved, and these, together with some damaged flour, etc., obtained from a depôt established some time before on the islands, as well as penguins, albatross eggs, and other productions of the group, precluded any immediate risk of starvation, though the prospects of speedy rescue were exceedingly remote. Captain Ree therefore pluckily determined to sail in search of help in one of the ship's boats, which was rendered almost as buoyant as a life-boat by fixing life-belts round it, while a cover of canvas decked it over almost completely. Two of the seamen accompanied him, eleven in all remaining at American bay. The adventurous voyage happily proved successful, rescue being brought by the S.S. *Turakina*, which conveyed the party in safety to Hobart. Mr. Bull added some notes on the Crozets, which, he says, showed many traces of volcanic origin. Grass grows luxuriantly in places, and would supply good fodder for sheep and goats. Bird-life is abundant, though the number of species is limited. Remains of the sealing establishments formerly existing in the group, but long abandoned, were seen in almost every bay. We have also received a manuscript map by Captain Ree, showing American bay and the adjacent parts of Possession island.

POLAR REGIONS.

Mr. Harrison's Arctic Expedition.—The following communication has been received by Sir Clements Markham from Mr. Alfred H. Harrison (*Journal*, vol. 27, p. 635; vol. 28, p. 512), dated Fort McPherson, Peel river, Mackenzie river, June 17, 1907. "I have had a tip-top time, and done much work during the winter, not in the quarter I should like to be, but, under the circumstances, in the best. Nothing arrived at Herschel island after writing to you, and so I engaged natives and took my whale-boat with two others into the Eskimo lakes. I came up here from Herschel island, and managed to get a few supplies, paying as much as £4 for 50 lbs. of flour. I had a number of cartridges and rifles, etc., here, which I took with me, and two good Huskie hunters, who had a whale-boat each. On September 20 I started down the east branch of the Mackenzie, to about 68° 40′ lat., where I reached a river which took me about 20 miles east into a large lake some 15 miles long. Here we left our whale-boat, and made a portage of 25 miles

over a height of land, into Eskimo lake. At the north side of Eskimo lake, which lies 25 miles north and south, in a small river connecting it with another large lake, we were fortunate in finding plenty of fish. There was no game whatever in the country, and here we took sixty-five to seventy white fish, weighing 2 lbs. each, out of one net each visit; so I decided to winter here. The fish lasted well into January, but as soon as the sun came back again we could not catch a fish either in nets or on hooks. During the winter I got four occultations at my winter camps, and many observations, doing triangulation at three stations about 25 miles apart. I went to the coast in January, and spent some time there, storm-bound most of the time, reaching the Arctic ocean in lat. 69° 48′, long. 133°, about 10 miles east of Tokea point. I travelled along the coast in both directions for three weeks, returning to my winter camp by another route, reaching it at the end of February. I carefully surveyed the routes I took, and have the heights of land passed over, also the timber-line. During this trip we had the coldest weather, making the travelling easy for the dogs; the thermometer registered −62° on February 18, this being the coldest. On the whole, it was a mild winter compared with 1906. On March 25 I started again with all my dogs and men and three sledges, and did intend to go by the lakes to Liverpool bay, and so connect my observations with those taken in July at Baillie islands. Unfortunately, we could not get any game or fish, so I had to turn to the coast in long. 130° 59′ 22″ and lat. 69° 43′ 22″. Here we made a portage of one long day in the bay between Point Warren and Phillips islands. I failed to find any inlet there as marked on the maps, and I heard from all the natives who hunt that country that no such inlet exists. We went along the coast to Richard island, reaching the coast (*sic*) on April 12, and the east branch of the Mackenzie river on May 10. During the whole of this time there was plenty of open water 25 miles from land, and a very deep water sky out to sea. I made several trips over the ice, and found nothing but smooth floe-ice everywhere. I then went up the east branch of the Mackenzie, travelling for nine days without taking our sledges ashore once, there being open water on both sides of the river, to where I left my boats, and got afloat on June 1, arriving here on the 15th. I have taken a great number of observations for latitude and longitude and variation of compass, and made a map of the west branch of the Mackenzie, also of the eastern branch, both of them from Point Separation, or rather Arctic Red river, to the ocean. I have collected all the information I can about the coast-line I have travelled over, and have made a map of it, with several observations. I have also made a map of the country extending from the eastern branch of the Mackenzie to 130° 69′ 22″ W., and from the coast up to 68° 40′ N. I hope to send in all my work this fall, as soon as a mail goes out of the country. Mr. Stefansson, who came down the Mackenzie last year, and is one of the Anglo-American Expedition, came to me in January for a month, returning with me to the coast. I have since heard from him that he was going to join his ship, and that Mr. Leffingwell made a trip to Herschel island in December, returning to the ship at once. I am hoping this season to get to Banks Land, and next spring to make a trip out on the ice. I am very pleased with the Eskimo hunters I had with me during the winter, and have had no trouble whatever, only a little shortage of food sometimes. I have enjoyed my work very much, and feel very deeply indebted to Mr. Reeves for all the trouble he took with me during my stay with him." In a second letter, written from the same place on July 20, Mr. Harrison discusses the conditions in the Beaufort sea, and gives what seem to him reasons for believing in the existence of hitherto unknown land to the north. He says: "When you are 50 miles off shore it is quite incredible where the ice comes from. Often, on looking back, an open water space that you have just steamed over is now a great

ice-field behind you, and the rapidity with which the ice comes and goes is wonderful. This is what keeps the whalers from going far off shore, for though it is not large enough to get on to with safety, it is not floe-ice, but a massive dark-blue ice, which even whalers have to treat with respect. It is very deep in the water, and looks to me as if it had been broken off very old massive ice by being continually carried backwards and forwards by the wind. From my own observation I feel sure there is land north of this, and probably quite close to Prince Patrick island. It looks to me like a great Polar continent. . . . Everywhere along this coast there is a great quantity of drift-wood, which comes from the Mackenzie river and other small rivers on the coast. Now, when I was off Banks Land last summer I could not see any drift-wood whatever, not even the smallest sort of wood. This surprised me very much, and there must be some reason for it. . . . From the varied course the ice takes, it is hard to understand why there should not be drift-wood here, and it could only be kept off the west shore of Banks Land by a regular current. . . . If there was a regular current running down the west shore of Banks Land from the north, with extensive ice-fields north and west, it must bring large quantities of ice with it. Now, vessels that have wintered at Cape Parry report open water there much earlier than anywhere else on the coast, and round Nelson head I believe there is open water all the year. I think there is a regular current down the west shore of Banks Land from the north, but there is probably land to the north and west, and this accounts for so little ice coming down." Mr. Harrison remarks on the exceptionally open character of the sea east of Point Barrow last year, owing to east winds, and thinks that, once east of the point, a ship could have reached Prince Patrick island. At the time of writing he was still hoping to get to Banks Land this year, and possibly to make a trip out on the ice. But recent reports indicate that he had gone down to Edmonton early in September. He has evidently done a large amount of good work, and it is to be hoped that he has not been compelled, for any reason, to abandon his expedition.

Captain Mikkelsen's Expedition.—The somewhat alarmist reports regarding the fate of this expedition circulated early in September have, happily, proved unfounded, so far as disaster to the *personnel* of the party is concerned. The ship of the expedition, the *Duchess of Bedford*, has, however, been lost—at "Fort Anxious"—a name which does not appear in the Admiralty charts.* The first telegrams, which seemed to give some ground for uneasiness, stated that the explorers had been away seventy days on a trip to the north, and that no news had been heard of them, though one of the dog-teams had returned. A telegram from Mr. Stefansson, one of the members of the party, soon, however, set all anxiety at rest, as it stated that the ice-trip had been safely accomplished. A second message, received at the Society from Dawson, on the upper Yukon, gave a few additional details. It stated that the sledge expedition had covered 500 miles, during which the edge of the continental shelf had been twice crossed. Soundings at a distance of 50 miles from the coast, and further out, gave no bottom at 630 metres (344 fathoms). No new land seems to have been discovered, and the statement that the edge of the continental shelf had been passed would seem to lessen the probability of its existence further out, at least in the part of the Beaufort sea traversed by the sledge party. In spite of the loss of the ship, Captain Mikkelsen still hopes to continue his work for another year, devoting

* The latest communication from Mr. Harrison, referred to above, states that water was fast gaining on the ship when Messrs. Mikkelsen and Leffingwell started on their trip, and that Mr. Stefansson and the doctor [Dr. Howe, of Cambridge] had soon afterwards to abandon her, saving all the stores.

1908 to further surveys and explorations in the Beaufort sea, and researches into the geology and ethnography of the region. The latest news is to the effect that Mr. Stefansson has reached Victoria, B.C., having left Mr. Mikkelsen and his companions at Herschel island in July, all well. He was then engaged in making sledges from the wrecked ship with a view to a trip over the ice of the Beaufort sea.

Dr. Bruce's Expedition.—Some anxiety was caused last month by news from Spitsbergen to the effect that Dr. Bruce and his party, who went out early in the summer to complete the researches began last year on the initiative of the Prince of Monaco, had failed to return to the coast from an expedition into the interior of Prince Charles Foreland, and that a search for him had proved fruitless. Captain Isachsen, who was again this year in charge of an expedition fitted out by the Prince, returned to Tromsoe on September 9, bringing with him Mr. Burn Murdoch, a member of Dr. Bruce's expedition, who had been left behind by the latter at the base camp on Prince Charles Foreland, and who reports that Dr. Bruce left the base camp on August 8, to proceed overland to a point near Cape Cold. On the 14th some of his companions came back for more provisions, whilst a note left by Dr. Bruce at Cape Cold, and dated August 23, stated that he hoped to be back at the camp on the 28th. News of the traveller's safe arrival at Tromsoe was received on September 23. A search seems to have been organized by the captain of a sloop which had proceeded to Prince Charles Foreland to await the return of the party, and this resulted in its discovery. Dr. Bruce was found in a state of much exhaustion, but he is said to have recovered.

Other Arctic Expeditions.—Commander Peary, who had intended to start on his new expedition during the present summer, has decided to postpone his departure for another year. Mr. Wellman also, who was to have started on his air-ship voyage towards the north pole during last August, has returned from Spitsbergen without making the attempt, the weather conditions not having proved sufficiently encouraging.

The Franklin Search.—Fiftieth Anniversary of the Sailing of the "Fox."—With reference to the correspondence on this subject which appeared in the August number of the *Journal*, it will be of interest to state that a communication has been received from Dr. D. Walker, who was formerly surgeon and naturalist on the *Fox*. He says that besides Sir Leopold M'Clintock and Sir Allen Young, he is the only survivor of the expedition. Dr. Walker, who resides at Portland, Oregon, in the United States, would have been glad to sign the letter to Sir Leopold M'Clintock had that been practicable.

GENERAL.

Lectureship in Ancient Geography.—The University of Liverpool has been enabled by munificent encouragement to establish a Lectureship in Ancient Geography, the first substantive post of the kind in this country. The occasion was afforded by a vacancy in the Gladstone Professorship of Greek, and the new post is to be held, together with the Greek Professorship, during the tenure of the new holder of the Chair, Mr. J. L. Myres, of Oxford. The combination marks a distinct advance in the organization of classical studies, and should permit instructive adaptation of these studies to modern educational needs. It is for its contribution to our knowledge of ancient Mediterranean life that the study of the Greek language has in any case its widest application; and the more closely this knowledge is correlated to our knowledge of the physique of the Mediterranean region, the better both for geographers and for scholars. Liverpool already possesses in Mr. Roxby a Lecturer in Geography of some standing, and the new lectureship is further proof, if that were needed, of the appreciation in which the more theoretical studies are held in that great centre of applied geography.

OBITUARY

Admiral J. F. L. P. Maclear.

We regret to record the death, which occurred suddenly at Niagara falls, as a result of heart-failure, towards the end of July, of Admiral J. F. Maclear, known to geographers for much excellent work as a hydrographical surveyor, and especially as having taken an important part in the famous voyage of the *Challenger*. He had been a Fellow of our Society since 1888.

The deceased admiral's bent towards the more scientific side of his profession was no doubt in part inherited, as he was the son of Sir T. Maclear, for many years Astronomer Royal at the Cape, the staunch friend of David Livingstone, whose geographical labours owed much to his consistent encouragement and co-operation. His son, John Fiot Lee Pearse Maclear, was born at the Cape in 1839, and, entering the Navy as a cadet in 1851, took part in the Kaffir war of that year, and subsequently in the Crimean war, for which he received three different medals, with the Sebastopol clasp. After further service on the Red sea, the China station (where he took part in the capture of the Taku forts, receiving the medal, with clasp), and in the East Indies, he took part in the Abyssinian Expedition of 1868, and for his services in this campaign received the medal and attained the rank of Commander. He had by this time displayed a marked aptitude for hydrographical work, and on the commissioning of the *Challenger* under Sir George Nares in 1872, he was appointed commander, in which capacity he did his full share of the scientific work of the voyage, at the close of which, in 1876, he was promoted to be captain. When, in 1879, Sir G. Nares relinquished the command of the *Alert* during her surveying voyage to the Straits of Magellan and other parts of the southern hemisphere, he was succeeded by Captain Maclear, under whose direction the objects of the voyage were successfully completed. He was in command of the survey ship *Flying Fish* from 1882 to 1887, and carried out a large amount of excellent work of various kinds. He became a rear-admiral in 1891 (in which year he retired), being promoted to vice-admiral in 1897, and admiral in 1903. During the latter part of his life he was engaged in the preparation of sailing directions for the hydrographical department of the Admiralty, particularly the portions of the "Arctic pilot" dealing with the waters north of Europe and America. These volumes bear abundant evidence to the industry with which he had made himself acquainted with the extensive literature of Arctic voyages, his knowledge of which was probably as intimate as that of any of his contemporaries.

Admiral Maclear was afflicted during his latter years with almost total deafness, an affliction which he bore, however, with much cheerfulness. His invariable courtesy and quiet, unassuming manners must have struck all with whom he was brought in contact. He married, in 1878, a daughter of the late Sir John Herschel, of whom his father had been a close friend and coadjutor during his life at the Cape.

The Earl of Dunmore.

Lord Dunmore, who had been a Fellow of the Society since 1860, and who died on August 27 at the Manor House, Frimley, near Camberley, was born on March 24, 1841, and succeeded his father (the sixth earl) in the earldom of Dunmore and the other family honours when a little over four years of age. He soon displayed a strong taste for travelling, hunting, and big-game shooting, avocations for which his strength, activity, and fine physique pre-eminently qualified him. Lord Dunmore had travelled

in many parts of the world, including Africa and the Arctic Regions, but his chief fame as an explorer rests on a year's journey, which he made in 1892 in company with Major Roche of the 3rd Dragoon Guards, from Rawal Pindi to Samarkand. The route lay across Kashmir to Leh, and thence by way of the Karakoram pass and Sanju to Yarkand. From Yarkand Lord Dunmore made his westward trip to the Pamirs at an exceptionally trying time of the year (it was autumn), traversing the Taghdumbash, Little and Great Pamirs, Alichur, and Rangkul, and returning to Kashghar by December 1. These explorations were made not long after Colonels Yonoff and Grombchevsky's movements in and about the same regions; and the mere fact of Lord Dunmore having built a rough bakehouse with a chimney on the Pamirs was magnified into the news that the English had erected a fort there, and led to some suspicious Chinese officials inflicting much annoyance on the party. From April 9, 1892, till January 1, 1893, between the Punjab and Ferghana, Lord Dunmore had walked and ridden 2500 miles, having traversed 41 mountain passes and 65 rivers in Kashmir, Baltistan, Ladak, Western Tibet, Chinese Turkistan, Sarikkol, and the Pamirs. Lord Dunmore's paper was read before the Royal Geographical Society on July 3, 1893, and in the ensuing discussion many interesting comments were made by Mrs. Bishop, Mr. G. N. (now Lord) Curzon, and Sir Thomas Gordon. The author's book, 'The Pamirs' (2 vols., Murray), appeared the same year.

The Rev. W. G. Lawes, D.D.

One of the pioneer missionaries, whose labours have done so much to open up the dark corners of the Earth, has passed away in the person of the Rev. W. G. Lawes, whose work in the Western Pacific and New Guinea, like that of his colleague Chalmers, who pre-deceased him by over six years, exercised an influence far beyond the sphere of his own special calling. His contributions to the geography of the great island, in which most of the latter part of his life was spent, are well known to members of the R.G.S., of which he became a Fellow in 1880.

Dr. Lawes' career as a missionary began in 1860, when, as quite a young man he was chosen to represent the London Missionary Society as permanent resident in the island of Niue (or Savage island), which, till that time, had only received occasional visits from the society's agents. Mr. Lawes resided here, with his wife, for over ten years, giving much attention—as he did in his later sphere of action—to the translation of the New Testament into the native language, as well as to his more immediate duties. In the early seventies he was transferred to New Guinea, with which the rest of his active career was to be associated. While settled at Port Moresby and elsewhere on the south coast, he made several voyages and journeys into the interior, and acquired valuable information on the geographical and other characters of this part of the island, which was brought to the notice of the Society in a paper printed in its *Proceedings* for 1880. He continued to make use of any opportunities that offered of extending his knowledge, and further short communications were printed in the volumes for 1882 and 1883. He took an important part in the ceremony by which the British protectorate over south-eastern New Guinea was inaugurated in 1884, translating into the native tongue the address then delivered by Commodore Erskine. Shortly afterwards, while on a visit to Sydney, a public meeting was held in honour of Dr. and Mrs. Lawes, to whom a similar mark of esteem was again accorded after Dr. Lawes' retirement from active work in 1906. At the time of his death, on August 6, he was living at Waverley, a suburb of Sydney. He leaves a widow and three sons.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Is. = Isvestiya.
J. = Journal.
Jb. = Jahrbuch.
k.k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps. **Baedeker.**
The Eastern Alps, including the Bavarian Highlands, Tyrol, Salzburg, Upper and Lower Austria, Styria, Carinthia, and Carniola. Handbook for travellers by Karl Baedeker. Eleventh edit. Leipsic: K. Baedeker, 1907. Size 6½ × 4, pp. xxvi. and 574. *Maps, Plans, etc. Price* 8*s*. *Presented by the Editor.*

Alps. **Ball.**
The Central Alps. Part i. (including those portions of Switzerland to the north of the Rhone and Rhine Valleys). By the late John Ball. New edition reconstructed . . . on behalf of the Alpine Club under the general editorship of A. V. Valentine Richards. London, etc.: Longmans & Co., 1907. Size 7½ × 5, pp. xxviii. and 328. *Maps. Price* 6*s*. 6*d*. *net. Two copies, presented by the Publishers and the Alpine Club.*

Alps. **Dübi.**
Conway and Coolidge's Climbers' Guides. The Bernese Oberland. Vol. 3. Dent de Morcles to the Gemmi. By H. Dübi. London: T. Fisher Unwin, 1907. Size 5 × 3, pp. xxiv. and 136. *Price* 10*s*. *net. Presented by the Publisher.*

Austria—Tirol. **Baillie-Grohman.**
The Land in the Mountains: being an account of the past and present of Tyrol, its people and its castles. By W. A. Baillie-Grohman, with an Introduction by Charles Landis. London: Simpkin & Co., 1907. Size 9 × 6, pp. xxxii. and 288. *Maps and Illustrations. Price* 12*s*. 6*d*. *net. Presented by the Publishers.*

France—Alps. *C.R.A. Sc. Paris* 144 (1907): 736–739. **Helbronner.**
Sur l'altitude du Grand Pic de la Meije. Par Paul Helbronner.

France—Bayonne. *Ann. G.* 16 (1907): 15–22. **Cavaillès.**
Le port de Bayonne. Par H. Cavaillès.

France—Census. *Rev. française* 32 (1907): 142–151. **Cilvanet.**
Le recensement de 1906 en France. Par C. Cilvanet. *With Sketch-maps.*

The total increase during the five years 1901–1906 amounted to only 290,322, as against 444,613 during the preceding quinquennium. The increase is, however, greater than was shown in the censuses of 1891 and 1896.

France—Census. ———

République française: Service du recensement. Résultats statistiques du recensement général de la population effectué le 24 mars 1901. Tome iv. Paris, 1906. Size $10\frac{1}{2} \times 8\frac{1}{4}$, pp. xxvi. and 998.

France—Cevennes. **Baring-Gould.**

A Book of the Cevennes. By S. Baring-Gould. London: John Long, [1907]. Size $7\frac{1}{2} \times 5$, pp. xii. and 308. *Sketch-map and Illustrations. Price 6s. Presented by the Publisher.*

France—Communications. *B.G. Hist. et Descript.* 1906: 165–172. **Bouquet de la Grye.**

Paris port de mer. Par Bouquet de la Grye.

Urges the importance of making Paris accessible to sea-going vessels.

France—Gascony. *B.G. Hist. et Descriptive,* 1906: 173–204. **Buffault.**

Les grandes étangs littoraux de Gascogne. Par Pierre Buffault.

France—Gironde. *B.G. Hist. et Descriptive,* 1906: 205–226. **Duffart.**

La sédimentation moderne des lacs médocains. Par Charles Duffart.

France—Haut-Dauphiné. *B.G. Hist. et Descriptive,* 1906: 35–64. **Jacob.**

Observations glaciaires dans le massif du Pelvoux, recueillies en août 1903 par MM. Flusin, Jacob, et Offner. Rapport par Charles Jacob. *With Illustrations.*

France—Languedoc. *B.S. Languedoc G.* **29** (1906): 105–136, 237–278, 364–387. **Sorre.**

La répartition des populations dans le Bas-Languedoc. Par Max Sorre. *With Maps and Diagrams.*

See note in the August number, p. 209.

France—Morbihan. *B.I. Océanographique Monaco,* No. 92 (1907): pp. 24. **Joubin.**

La presqu'île de Quiberon. Par L. Joubin. *With Map, Illustrations, and Diagrams.*

France—S.W. Coast. *B.G. Hist. et Descriptive,* 1906: 227–244. **Saint-Jours.**

Routes romaines de Pampelune à Bordeaux, et étude sur les sables du littoral gascon. Par Saint-Jours. *With Maps.*

France—Volcanoes. *C.R.A. Sc. Paris* **144** (1907): 403–405, 527–530. **Glangeaud.**

Des divers modes de l'activité volcanique dans la chaîne des Puys. Par Ph. Glangeaud.

Les laves et les mineraux des volcans de la chaîne des Puys. Age et cause des éruptions. Note de Ph. Glangeaud.

Russia—Cartography. **Pollacchi.**

Lecture des cartes russes. Indications linguistiques, géographiques et topographiques. Par le Capitaine P. Pollacchi. Paris: R. Chapelot et Cie., 1907. Size $10 \times 7\frac{1}{2}$, pp. x. and 94. *Price 6 fr. Presented by the Author.*

A useful work, the bulk of which forms a dictionary of geographical terms, with their customary symbols and abbreviations, employed in Russian maps. It includes not only those of Russian origin, but those in other languages used by neighbouring races (Turkish, Persian, Afghan, etc.). There are also tables for conversion of Russian linear measures into the metric system, and a comparative view of other measures, weights, etc.

Scandinavia. **Cook.**

Cook's handbook to Norway and Denmark, with Iceland and Spitsbergen. Sixth edition. London: Simpkin & Co., 1907. Size $7 \times 4\frac{1}{2}$, pp. 256. *Maps. Price 1s. 6d. Presented by the Publishers.*

Spain. **Villaescusa.**

Les provincias de España: descripción gráfica física y política de las mismas. Por el Dr. Modesto Hernández Villaescusa. Barcelona: M. Soler, 1905. Size $6\frac{1}{2} \times 4$, pp. 384. *Maps and Illustrations. Price 2s. 6d.*

A useful outline of the geography of Spain, physical and economic, by provinces.

Spain. ———

Nomenclátor de las ciudades, villas, lugares, aldeas, y demás entidades de población de España, formado por la Dirección General del Instituto Geográfico y Estadístico, con referencia al 31 de Diciembre de 1900. 2 vols. Madrid, 1904. Size $13\frac{1}{2} \times 10$, pp. (vol. 1) xliv. and 838; (vol. 2) 1004. *Price 28s.*

Supplies for the first time a sound basis for the statistics of Spanish demography.

Switzerland. **Baedeker.**

Switzerland and the adjacent portions of Italy, Savoy, and Tyrol. Handbook for Travellers, by Karl Baedeker. 22nd edit. Leipzig: Karl Baedeker (London: Dulau & Co.), 1907. Size 6½ × 4, pp. xlii. and 552. *Maps, Plans, and Panoramas. Price 8 marks. Two Copies, presented by the Editor and the Publishers.*

Switzerland. **Knapp and Others.**

Geographisches Lexikon der Schweiz. Mit dem Beistande der Geographischen Gesellschaft zu Neuenberg herausgegeben unter der Leitung von Charles Knapp, Maurice Borel, und V. Attinger. Deutsche Ausgabe, besorgt von Heinrich Brunner. IV. Band: Plessur-Schweiz. Neuenberg, 1906. Size 11 × 8, pp. viii. and 770. *Maps and Illustrations. Presented by Dr. H. Brunner.*

This important work (originally issued in a French version by the Geographical Society of Neuchâtel) will be reviewed when the concluding volume has been received.

United Kingdom—England. **Leland.**

The itinerary of John Leland in or about the years 1535–1543. Parts i.–iii. Edited by Lucy Toulmin Smith. London: George Bell & Sons, 1907. Size 9 × 6¼, pp. xlviii. and 352. *Maps and Portrait. Price 18s. net. Presented by the Publishers.*

See p. 435, *ante*.

United Kingdom—Lincoln. **Burton.**

The shaping of Lindsey by the Trent. By F. M. Burton. London, etc.: A. Brown & Sons, [1907]. Size 7½ × 5, pp. xii. and 60. *Diagrams and Illustrations. Price 2s. net. Presented by the Publishers.*

An attempt to trace the evolution of the district between the lower Trent and the North sea under the action of the river and its changes of course. There are some excellent photos of the bore on the Trent.

United Kingdom—Liverpool. **Muir.**

A history of Liverpool. By Ramsay Muir. London: Williams & Norgate (for University Press of Liverpool), 1907. Size 8½ × 5½, pp. xvi. and 372. *Plans and Illustrations. Price 6s. net. Presented by the Publishers.* [To be reviewed.]

ASIA.

Afghanistan. **Martin.**

Under the Absolute Amir. By Frank A. Martin. London: Harper & Bros., 1907. Size 9 × 6, pp. xii. and 330. *Illustrations. Price 10s. 6d.*

Asia. **Penfield.**

Wanderings East of Suez: in Ceylon, India, China, and Japan. By Frederic Courtland Penfield. London: G. Bell & Sons, 1907. Size 8½ × 5½, pp. xviii. and 350. *Illustrations. Price 10s. 6d. net. Presented by the Publishers.*

Central Asia—Zoology. **Salensky.**

Prjevalsky's Horse (*Equus Prjewalskii Pol.*). By W. Salensky. Translated by Captain M. Horace Haynes and O. Charnock Bradley; with an Introduction by J. Cossar Ewart. London: Hurst & Blackett, 1907. Size 9 × 5½, pp. xvi. and 65. *Illustrations. Price 5s. Presented by the Publishers.*

See p. 435, *ante*.

Ceylon—Rubber. **Willis, Bamber, and Denham.**

Peradeniya manuals of botany, entomology, agriculture, and horticulture. No. 1. Rubber in the East: being the official account of the Ceylon rubber exhibition held in the Royal Botanic Gardens, Peradeniya, in September, 1906. Edited by J. C. Willis, M. Kelway Bamber, and E. B. Denham. Colombo: Government Printer, 1906. Size 8½ × 5½, pp. 270. *Maps and Illustrations. Presented by the Colonial Office.*

China—Chi-li. **Hedley.**

On tramp among the Mongols. By the Rev. John Hedley. (Reprinted from the *North China Daily News.*) Shanghai, 1906. Size 9½ × 6, pp. vi. and 118. *Map and Illustrations. Presented by the Author.*

The trip was undertaken for the purpose of geographical research as well as missionary investigations. Its results from the former point of view were given in the *Journal* for May last (vol. 29, p. 545).

China—Language. **Hillier.**

The Chinese Language and how to learn it. A manual for beginners. By Sir

Walter Hillier. London: Kegan Paul & Co., 1907. Size 9 × 6, pp. vi. and 264. *Price* 12*s.* 6*d. net. Presented by the Publishers.*

This seems the most practical guide to the acquisition of an elementary knowledge of Chinese that has yet appeared.

China—Manchuria. **Seaman.**

From Tokio through Manchuria with the Japanese. By Dr. L. L. Seaman. New York: D. Appleton & Co., 1905. Size 8 × 5, pp. xvi. and 268. *Illustrations. Presented by the Author.*

China—Manchuria. **Seaman.**

The real triumph of Japan. The conquest of the silent foe. By Dr. L. L. Seaman. New York: D. Appleton & Co., 1907. Size 8 × 5, pp. xii. and 292. *Illustrations. Presented by the Author.*

Chinese Turkestan. **Stein.**

Ancient Khotan: detailed report of archæological explorations in Chinese Turkestan, carried out and described under the orders of H.M. Indian Government by M. Aurel Stein. 2 vols. Oxford: Clarendon Press, 1907. Size 12½ × 10, pp. (vol. **1**) xxiv. and 622; (vol. **2**) viii. *and Plates. Map, Plans, and Illustrations. Price* 5 *gns. net. Presented by the Publishers.* [To be reviewed.]

French Indo-China—Cambodia. **Lajonquière.**

Publications de l'Ecole Française d'Extrême-Orient. Inventaire descriptif des monuments du Camboge. Par E. Lunet de Lajonquière. Tome ii. Paris: E. Leroux, 1907. Size 11 × 7, pp. xlvi. and 356. *Plans and Illustrations. Price* 15 *fr. Presented.*

India. **Lyall.**

The rise and expansion of the British dominion in India. By Sir Alfred Lyall. Fourth edition. London: John Murray, 1907. Size 9 × 6, pp. xx. and 388. *Maps. Price* 5*s. net. Presented by the Publisher.*

A new chapter is added in this edition giving a brief survey of Indian affairs from 1858 to the present time.

India—Chota Nagpur. **Hahn.**

Einführung in das Gebiet der Kolsmission. Geschicht, Gebräuche, Religion und Christianisierung der Kols. Von Ferdinand Hahn. Gütersloh, 1907. Size 8½ × 5½, pp. viii. and 160. *Price* 2*m. Presented by the Publisher.*

A detailed account of the Kols.

India—Gazetteer. ——

The Imperial Gazetteer of India. The Indian Empire. Vol. **1**, descriptive; vol. **3**, economic; and vol. **4**, administrative. Oxford: The Clarendon Press, 1907. Size 8½ × 5½, pp. (vol. **1**) xxxii. and 568; (vol. **3**) xxxvi. and 520; (vol. **4**) xxx. and 552. *Map. Price* 6*s. net per vol. Presented by the India Office.*

This, with vol. **2** not yet received, will form the general section (almost entirely re-written) of the new edition of Hunter's 'Gazetteer of India,' issued under the general supervision of Mr. J. S. Cotton, in association with an editor for India and other coadjutors. Mr. Cotton was closely associated with Sir W. Hunter in the preparation of the earlier editions.

India—Himalaya. *La G., B.S.G. Paris* **15** (1907): 93–102. **Workman.**

Exploration du Nun-Kun. Par Fanny Bullock Workman. *With Illustrations.*

A short account of the journey appeared in the *Journal* for November, 1906, p. 505.

India—Nepal. **Vansittart.**

Handbooks for the Indian Army. Gurkhas. Compiled by Lieut.-Colonel Eden Vansittart. Calcutta, 1906. Size 10 × 7, pp. vi., 200, and x. *Map.*

India—Rajputana. **Ram Din.**

Geography of Rajputana. By Pandit Ram Din. 2 parts. Size 8½ × 5½, pp. (part i.) 36; (part ii.) 96. *Map.* [In Hindi.]

Japan—Formosa. *La G., B.S.G. Paris* **15** (1907): 46–49. **Kann.**

Travaux d'exploration et de topographie accomplis par les Japonais dans l'île de Formose. Par Réginald Kann. *With Map.*

Malay Peninsula. *J.S. Arts* **55** (1906–7): 493–512. **Treacher.**

British Malaya, with more especial reference to the Federated Malay States. By Sir William Hood Treacher.

Malay States. **Belfield.**

Handbook of the Federated Malay States. Compiled by H. Conway Belfield. Third edition. London: E. Stanford, [1907]. Size $8\frac{1}{2} \times 5\frac{1}{2}$, pp. 184. *Maps and Illustrations. Price 2s. 6d. Presented by the Publisher.*

The attention directed to the Malay States of late, especially in connection with rubber, has caused a new edition of this well-known handbook to be quickly called for. It has been largely re-written to bring it into accord with the rapidly changing conditions in these states.

Persian Gulf. **Roobacker and Hotz.**

Cornelis Cornelisz. Roobacker's Scheepsjournaal Gamron-Basra (1645); de eerste reis der Nederlanders door de Perzische Golf. Uitgegeven, met inleiding en noten, door A. Hotz. (Overgedrukt uit het *Tijdschrift van het K. Nederlandsch Aardrijkskundig Genootschap*, 2e Ser., dl. xxiv., 1907.) (Leyden), 1907. Size 10 × 6, pp. 118 [289–405]. *Maps. Presented by the Author.* [To be reviewed.]

Philippines. *Philippine J. Sc.* 1 (1906): 433–437. **Bacon.**

The waters of the crater lakes of Taal volcano, with a note on some phenomena of radio-activity. By R. F. Bacon.

Philippines—Coal. *Philippine J. Sc.* 1 (1906): 877–902. **Cox.**

Philippine coals and their gas-producing power. By Alvin J. Cox. *With Illustration.*

Russia—Caucasus. **Déchy.**

Kaukasus: Reisen und Forschungen im kaukasischen Hochgebirge. Von Moriz von Déchy. Band iii. Bearbeitung der gesammelten Materialien. Von F. Filarszky, E. Csiki, K. Papp, F. Schafarzik und M. von Déchy. Berlin: D. Reimer, 1907. Size 12 × $8\frac{1}{2}$, pp. x. and 404. *Plates. Price 40m. Presented by the Publisher.*

See review, *ante*, p. 427.

Turkey—Arabia Petræa. **Musil.**

Arabia Petræa. Von Alois Musil. I. Moab. Topographischer Reisebericht. Wien: A. Hölder, 1907. Size 10 × 7, pp. xxiv. and 444. *Plans and Illustrations. Presented by the Kaiserliche Akademie der Wissenschaften, Wien.* [To be reviewed.]

AFRICA.

British Central Africa—Ethnology. **Rattray.**

Some Folk-lore Stories and Songs in Chiyanja, with English translation and notes. By R. Sutherland Rattray, with preface by Rev. Alexander Hetherwick. London: Society for Promoting Christian Knowledge, 1907. Size $6\frac{1}{2} \times 4$, pp. 224. *Presented by the Author.*

Egypt. *G.Z.* 13 (1907): 1–23, 71–92. **Jaeger.**

Ägypten. Von Fritz Jaeger. *With Illustrations.*

Egypt—Meteorology. ——

Survey Department, Egypt. Meteorological Report, 1904. Part i. Helwan Observatory. Cairo, 1906. Size $14\frac{1}{2} \times 10\frac{1}{2}$, pp. viii. and 50.

Egypt and Sudan. ——

Egypt. No. 1 (1907). Reports by His Majesty's agent and Consul-General on the finances, administration, and condition of Egypt and the Soudan in 1906. London, 1907. Size 13 × $8\frac{1}{2}$, pp. viii. and 160. *Price 1s. 4d.*

See August number, p. 213.

Egyptian Sudan. **Budge.**

The Egyptian Sudan: its history and monuments. By Dr. E. A. Wallis Budge. 2 vols. London: K. Paul, Trench, Trübner & Co., 1907. Size 10 × 7, pp. (vol. 1) xxviii. and 652; (vol. 2) x. and 618. *Maps, Plans, and Illustrations. Price 42s. net. Presented by the Publishers.*

The bulk of the first volume consists of narratives of the author's three archæological missions, while the second presents a history of the Egyptian Sudan from the earliest times, including an account of the progress made under the Anglo-Egyptian Condominium. The portion dealing with the early history is of special interest.

See review in the September number, p. 325.

Egyptian Sudan. ——

Trade of Port Sudan for the year 1906. (Foreign Office, Annual No. 3755, 1907.) Size $9\frac{1}{2} \times 6$, pp. 16.

See September number, p. 333.

Eritrea—Volcanoes. *Riv. G. Italiana* 14 (1907): 16–26. **Dainelli and Marinelli.**
Vulcani attivi della Dancalia. Considerazione di G. Dainelli e O. Marinelli.

French Sudan. *B.G. Hist. et Descriptive*, 1906: 65–81. **Desplagnes.**
Le plateau central nigérien. Par Desplagnes. *With Map.*

The writer has also written a book on the same subject (see p. 224, *ante*).

Rhodesia—Language. **Smith.**
A handbook of the Ila language (commonly called the Seshukulumbwe) spoken in North-Western Rhodesia, South-Central Africa; comprising grammar, exercises, specimens of Ila tales, and vocabularies. By Edwin W. Smith. London: H. Frowde, 1907. Size 7½ × 5, pp. xii. and 488. *Price 15s. net. Presented by the Publisher.*

The first attempt to reduce to system a language which was still unwritten when the author first reached the country.

Transvaal. **Praagh.**
The Transvaal and its mines. (The encyclopedic history of the Transvaal.) Edited by L. V. Praagh. London and Johannesburg: Praagh & Lloyd, [1907]. Size 12½ × 9½, pp. 640 and viii. *Sketch-maps and Illustrations. Presented by the Transvaal Government.*

NORTH AMERICA.

America—Bibliography. ———
Rare Americana, for sale by H. Stevens, Son, & Stiles . . . , preceded by a brief account of the original Waldseemüller World-Maps of 1507 and 1516. [London, 1907.] Size 10 × 6, pp. xvi. and 132.

Besides including the titles of many valuable early works on America, this catalogue contains the interesting announcement that Prince Waldburg of Wolfegg has decided to offer for sale the original copies of the Waldseemüller maps discovered by Prof. Fischer some five years ago. The price fixed by the Prince, which is said to be subject to no reduction, is 60,000 guineas. Mr. Stevens, who is known as an authority on early Americana, supplies a brief account of the maps, based on his personal study of them.

British North America. **Selous.**
Recent hunting trips in British North America. By F. C. Selous. London: Witherby & Co., 1907. Size 9 × 6, pp. 400. *Illustrations. Price 16s. net. Presented by the Publishers.*

Vivid sketches of hunting experiences in Newfoundland, Central Canada, and the Canadian Yukon territory since 1900. The illustrations include two or three interesting photos of caribou from the life, by Mr. S. H. Parsons.

Canada—New Brunswick. **Ganong.**
Additions and corrections to monographs on the place-nomenclature, cartography, historic sites, boundaries, and settlement-origins of the province of New Brunswick. By Dr. W. F. Ganong. (From the *Transactions* of the Royal Society of Canada, Second Series, 1906–07, vol. 12.) Ottawa, etc., 1906. Size 10 × 6½, pp. 158 and viii. *Maps.*

Canada—Place-names. ———
Sixth Report of the Geographic Board of Canada, containing all decisions to June 30, 1906. Ottawa, 1906. Size 10 × 6½, pp. 82.

Mexico—Railway. *B. American G.S.* 39 (1907): 78–91. **Hovey.**
The Isthmus of Tehuantepec and the Tehuantepec National Railway. By Edmund Otis Hovey. *With Map and Illustrations.*

Mexico—Railway. ———
Mexico Isthmus (Tehuantepec) Railway. (Foreign Office, Miscellaneous, No. 658, 1907.) Size 9¼ × 6, pp. 20.

See note in the Monthly Record (July, p. 93).

Newfoundland. **MacGregor.**
Address by H. E. Sir William MacGregor, delivered at the opening of the Newfoundland Agricultural Exhibition . . . , October 17, 1906. (St. Johns, 1906.) Size 13½ × 8½, pp. 6. *Presented by the Author.*

North America—West Coast. **Meany.**
Vancouver's discovery of Puget Sound; portraits and biographies of the men honoured in the naming of geographic features of North-Western America. By

Edmund S. Meany. New York: The Macmillan Co., 1907. Size 8½ × 5½, pp. xviii. and 344. *Portraits and Illustrations. Price 10s. 6d. net.*

After some introductory chapters, treating briefly of the general history of the opening up of North-West America, the author reprints the section of Vancouver's narrative bearing on his discoveries in that region, giving biographical notices and portraits of the men whose names were then applied to geographical features. The work has evidently involved much research.

United States—Maryland. ———

Maryland Geological Survey. Pliocene and Pleistocene. Baltimore: The Johns Hopkins Press, 1906. Size 10½ × 7, pp. 292. *Maps and Illustrations.*

This has a distinctly geographical bearing, the present topographic forms being considered in relation to the geological history.

CENTRAL AND SOUTH AMERICA.

Argentine. **Koebel.**

Modern Argentina, the El Dorado of to-day; with notes on Uruguay and Chile. By W. H. Koebel. London: Francis Griffiths, 1907. Size 9 × 6, pp. xvi. and 380. *Illustrations. Price 12s. 6d. net. Presented by the Publisher.*

Brazil—São Paulo. ———

Commissão geographica e geologica do Estado de S. Paulo. Exploração do rio Tieté (Barra do rio Jacaré-Guassú ao rio Parana), 1906. São Paulo, 1907. Size 17½ × 13, pp. 18. *Maps and Illustrations. Presented by the Commission.*

Central America. **Aflalo.**

Sunshine and sport in Florida and the West Indies. By F. G. Aflalo. London: T. Werner Laurie, [1907]. Size 9 × 5½, pp. xvi. and 272. *Illustrations. Price 16s. net. Presented by the Publisher.*

Central America. **Merz.**

Beiträge zur Klimatologie und Hydrographie Mittelamerikas. Von Dr. Alfred Merz. Leipzig, [*not dated*]. Size 8½ × 5½, pp. 96. *Map and Diagrams. Presented by the Author.*

Ecuador—Geodesy. *La G., B.S.G. Paris* **15** (1907): 81-92. **Lallemand.**

Opérations de la mission pour la mesure d'un arc de méridien en Equateur. Rapport du Commandant Lallemand. *With Map and Illustrations.*

Falkland Islands. *Münchener G. Studien* **20** (1906): pp. viii. and 100. **Steckele.**

Die "Steinströme" der Falklandinseln. Von Bernhard Steckele. *With Sketch-map and Diagrams.*

Panama. **Barbour.**

A history of William Paterson and the Darien Company. By James Samuel Barbour. Edinburgh, etc.: W. Blackwood & Sons, 1907. Size 8 × 5, pp. xii. and 284. *Maps and Illustrations. Price 6s. net. Presented by the Publishers.*

The first connected narrative of the fortunes of the ill-starred Darien Company for the establishment of a Scottish settlement in Central America about the year 1700.

Panama—Canal. **Waldo.**

The Panama Canal Work and the Workers. A personal study of actual conditions. By Fullerton L. Waldo. (Reprinted from the *Engineering Magazine*, February, 1907.) New York, 1907. Size 9 × 6, pp. 703-716. *Illustrations.*

Peru—Meteorology. *B.S.G. Lima* **19** (1906): 1-58. **Victoria.**

Evaporación y frío producido por ella en Lima. Por Ernesto G. Victoria.

West Indies—Danish. *G. Ts.* **19** (1907-8): 6-11. **Bøggild.**

Om Dansk-Vestindiens Geologi. Af O. B. Bøggild. *With Illustrations.*

West Indies—Grenada. *Globus* **91** (1907): 232-239. **Sapper.**

Grenada. Von Carl Sapper. *With Illustrations.*

AUSTRALASIA AND PACIFIC ISLANDS.

Australasia. **Rogers.**

A historical geography of the British Colonies. Vol. 6—Australasia. By J. D. Rogers. Oxford: Clarendon Press, 1907. Size 7½ × 5, pp. viii., 308, and 132. *Maps. Price 7s. 6d. Presented by the Publishers.* [To be reviewed.]

Australasia—Ethnology. **Brown.**

Maori and Polynesian: their origin, history, and culture. By J. Macmillan Brown. London: Hutchinson & Co., 1907. Size $7\frac{1}{2} \times 5$, pp. xxxii. and 300. *Price 6s. net. Presented by the Publishers.*

Australia. **Ward and Fountain.**

Rambles of an Australian naturalist. Written by Paul Fountain from the Notes and Journals of Thomas Ward. London: John Murray, 1907. Size $9 \times 5\frac{1}{2}$, pp. viii. and 344. *Price 10s. 6d. net. Presented by the Publisher.*

New Zealand—Geology. *New Zealand Geol. Surv., B.* 2 (1906): pp. vi. and 52. **Park.**

The geology of the Area covered by the Alexandra Sheet, Central Otago Division (including the Survey Districts of Leaning Rock, Tiger Hill, and Poolburn). By James Park. *With Maps, Sections, and Illustrations.*

Pacific Islands—Ethnology. *B.G. Hist. et Descriptive* (1906): 24-34. **Hamy.**

Les collections anthropologiques et ethnographiques du voyage de découvertes aux Terres australes (1801–1804). Par le Dr. E. T. Hamy.

The writer has succeeded in partly tracing the fortunes of the ethnographical collections made by the expedition of Baudin and Péron.

Queensland. *Queensland G.J.* **21** (1905–06): 1–13. **Cameron.**

A Review of the Pastoral Industry of the state of Queensland since 1865. By John Cameron.

South Australia. *Victorian G.J.* **23-4** (1905-06): 72–78. **Barclay.**

Recent Central Australian Exploration. By Captain H. V. Barclay.

South Australia. *Victorian G.J.* **23-4** (1905–06): 10–18. **Bradshaw.**

The North Coast of Arnheim Land (Northern Territory of South Australia). By Captain Joseph Bradshaw.

Torres Straits. **Ray.**

Reports of the Cambridge Anthropological Expedition to Torres Straits. Vol. **3.** Linguistics. By Sidney H. Ray. Cambridge: University Press, 1907. Size $11\frac{1}{2} \times 8\frac{1}{2}$, pp. x. and 528. *Maps. Price 30s. net. Presented by the Publishers.*

The bulk of the work treats in detail of the structure and vocabularies of the languages in question; but the question of relationships, etc., is briefly discussed, and the conclusions are concisely stated in a "general linguistic summary" on the last page.

Victoria. **Gregory.**

The Geography of Victoria—Historical, Physical, and Political. By Dr. J. W. Gregory. Melbourne, etc.: Whitcombe & Tombs, [1903]. Size $7 \times 4\frac{1}{2}$, pp. 290. *Maps and Illustrations. Presented by the Author.*

Practically the first geography of Victoria written from a scientific point of view.

Victoria—Boundary. *Victorian G.J.* **23-4** (1905-06): 78–106. **Ogier.**

The Victorian State Boundary. By J. C. H. Ogier.

The writer holds that the original boundary intended to be laid down by the Act of Separation was the Murrumbidgee. Many early documents are quoted.

Western Australia—Commercial. *J.R. Col. I.* **38** (1906-07): 275-294. **Rason.**

Western Australia and its Resources. By Hon. C. H. Rason.

POLAR REGIONS.

Antarctic—British Expedition. **[Scott and others.]**

The South Polar Times. 2 vols. London: Smith, Elder, & Co., 1907. Size $11\frac{1}{2} \times 8\frac{1}{2}$, pp. (vol. **1**) x. and 213; (vol. **2**) viii. and 166. *Maps and Illustrations. Price 5 gns. Presented by the Publishers.*

Facsimile reproduction of the journal issued during the course of the British Antarctic expedition.

Greenland—Eskimo. **Rasmussen.**

Knud Rasmussen. Neue Menschen: ein Jahr bei den Nachbarn des Nordpols. Einzig autorisierte Uebersetzung von Elsbeth Rohr. Bern: A. Francke, 1907. Size $8\frac{1}{2} \times 5\frac{1}{2}$, pp. viii. and 192. *Illustrations. Price 3.60m. Presented by the Publisher.*

The author, who was a member of the Mylius-Erichsen expedition to Greenland, here gives the results of his observations on the life and habits of the Eskimo.

Polar Congress. ———

Congrès International pour l'Étude des Régions Polaires tenu à Bruxelles du 7 au 11 Septembre 1906, sous le haut patronage du gouvernement belge. Rapport d'ensemble, documents préliminaires et compte rendu des séances. Bruxelles, 1906. Sizes 9½ × 6, pp. 312 and [78]. *Plan.*

Polar Regions—Marine Fauna. **Kükenthal.**

Veröff. I. f. Meereskunde u. G.I., Berlin, Heft 11 (1907): pp. 28.

Die marine Tierwelt des arktischen und antarktischen Gebietes in ihren gegenseitigen Beziehungen. Von Prof. W. Kükenthal.

Spitsbergen. *Scottish G. Mag.* **23** (1907): 141–156. **Bruce.**

Prince Charles Foreland. By William S. Bruce. *With Map and Illustrations.*

Mr. Bruce accompanied the Prince of Monaco during last summer's cruise (*Journal*, vol. **29**, p. 462), and made an examination of the island.

Spitsbergen—Geodesy. ———

Missions scientifiques pour la mesure d'un arc de méridien au Spitzberg, entreprises en 1899–1901 sous les auspices des gouvernements russes et suédois. Mission russe. Tome I. Géodésie. 3e Section: A. b., Mensuration de la base avec l'appareil de Jäderin (pp. 138); 3e Section: B., Réductions aux centres (pp. 68); 3e Section: C., Réseau de la base (pp. 36); 4e Section: B., Determination des attractions locales sur les points astronomiques du réseau principal des triangles (pp. 58); 5e Section: Intensité de la pesanteur (pp. 124). St. Petersburg, 1904–05. Size 12½ × 10. *Maps, Diagrams, and Illustrations.*

MATHEMATICAL GEOGRAPHY.

Tables. **Ball.**

Altitude tables computed for intervals of 4′ between the parallels of Latitude 31° and 60° and parallels of Declination 0° and 24°, designed for the determination of the position line at all hour angles without logarithmic computation. By Frederick Ball. London: J. D. Potter, 1907. Size 10½ × 7½, pp. xxxii. and 242. *Price 15s. net. Presented by the Author.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geology—Pelagosite. **Allemandet.**

B.I. Océanographique, Monaco, No. 91 (1907): pp. 12.

Analyse de quelques échantillons de Pélagosite recueillis dans le port de Monaco. Par G. H. Allemandet. *With Illustration.* [In French and Esperanto.]

Pelagosite is a dark grey deposit occurring on the dolomitic rocks of some coasts.

Geophysics. *Monthly Weather Rev.* **34** (1906): 559–561. **[Abbe.]**

Changes of Latitude and Climate. By C. A.

Geophysics. *Vierteljahrsschrift Naturfors. Ges. Zürich* **51** (1906): 229–235. **Gugler.**

Versuch einer Erklärung der durch Pendelbeobachtungen konstatierten Massendefekte unter Gebirge und Hochländern. Von K. Gugler.

Geophysics. *Atti R.A. Lincei, Rendiconti,* Ser. V., **16** (1907): 1 Sem., 499–507. **Marchi.**

Applicazioni geologiche della teoria elastica delle dislocazioni tectoniche. Di Luigi de Marchi.

Geophysics. **See.**

The Cause of Earthquakes, Mountain Formation, and Kindred Phenomena connected with the Physics of the Earth. By T. J. J. See. (Reprinted from *Proceedings of the American Philosophical Society,* vol. **45**.) [Philadelphia, 1907.] Size 9½ × 6½, pp. 273–414. *Maps and Illustrations.*

Glacial Epoch. *Science* **25** (1907): 350–354. **Hilgard.**

The Causes of the Glacial Epoch. By E. W. Hilgard.

A defence of Dr. Marsden Manson's theory, first put forward in 1891.

Lakes. *Petermanns M.* **53** (1907): 42–46. **Erdmann.**

Die Katatrophe von Mansfeld und das Problem des Coloradoflusses. Ein Beitrag zur Geschichte der Salzseen und Salzsteppen von Prof. Dr. H. Erdmann. *With Maps.*

The chief reason for associating the disappearance of the Mansfeld lakes in 1892 through subsidence of the ground) with the recent filling of the Salton depression by the Colorado, seems to be that the writer has personally studied both localities.

Limnology—Seiches. *Z. Ges. E. Berlin* (1907): 5–24. **Halbfass.**

Der heutige Stand der Seiches-Forschung. Von Prof. Dr. W. Halbfass.

Limnology. **Magrini.**

Dott. G. P. Magrini. Limnologia; studio scientifico dei laghi. (Manuali Hoepli; Serie Scientifica, 372–373.) Milano: Ulrico Hoepli, 1907. Size 6 × 4, pp. xvi. and 242. *Map and Diagrams. Price* 3 *lire. Presented by the Publisher.*

A clear and compact treatise on limnology, dealing both with the principles of the science and with practical methods of research. The position, size, and morphological characters of the principal Italian lakes are summarized in appendices.

Physical Geography. **Lapparent.**

Leçons de géographie physique. Par Albert de Lapparent. Troisième édition. Paris: Masson & Cie., 1907. Size 10 × 6½, pp. xvi. and 728. *Maps, Illustrations, and Diagrams. Presented by the Author.*

Volcanoes. **Mercalli.**

G. Mercalli. I vulcani attivi della terra: morfologia; dinamismo; prodotti; distribuzione geografica; cause. Milano: Ulrico Hoepli, 1907. Size 9½ × 6½, pp. viii. and 422. *Maps and Illustrations. Price* 10 *lire. Presented by the Publisher.*

Zoogeography. ——

Guide to the great game animals (Ungulata) in the Department of Zoology, British Museum (Natural History). London, 1907. Size 8½ × 5½, pp. viii. and 90. *Illustrations. Price* 1*s. Presented by the Museum.*

Zoogeography—Bird-migration. *Naturw. Wochenschrift* **22** (1907): 293–296. **Spill.**

Fernrohrbeobachtungen über den Wanderflug der Vögel. Von Wilhelm Spill.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Commercial. **Gannett.**

Statistical abstract of the World. By Henry Gannett. First Edition. New York: J. Wiley & Sons (London: Chapman & Hall), 1907. Size 6 × 4, pp. viii. and 84. *Price* 75 *cents* (3*s. net*). *Presented by the Publishers.*

Brought out on the "Multum in parvo" principle, giving a large amount of useful information in the minimum of space.

Commercial—Gold. **Launay.**

L'or dans le monde; géologie—extraction—économie politique. Par L. de Launay. Paris: A. Colin, 1907. Size 7½ × 5, pp. xxii. and 266. *Price* 3.50 *fr. Presented by the Publisher.*

Commercial—Peat. **Björling and Gissing.**

Peat: its uses and manufacture. By Philip R. Björling and Frederick T. Gissing. London: C. Griffin & Co., 1907. Size 8 × 5, pp. xii. and 174. *Illustrations. Price* 6*s. net. Presented by the Publishers.*

Historical—Voyages. **Purchas.**

Hakluytus Posthumus, or Purchas His Pilgrimes. Contayning a History of the World in Sea Voyages and Lande Travells by Englishmen and others. By Samuel Purchas. Vol. **20**. Glasgow: J. MacLehose & Sons, 1907. Size 9 × 6, pp. xii. and 416. *Facsimile-maps. Price* 12*s.* 6*d. net. Presented by the Publishers.*

The greater part of this volume, which completes the work (*cf.* review, *ante*, p. 434), consists of the index.

BIOGRAPHY.

Bentley. **Bentley.**

W. Holman Bentley: the Life and Labours of a Congo Pioneer. By H. M. Bentley. London: The Religious Tract Society, 1907. Size 8½ × 5½, pp. xx. and 446. *Map, Portraits, and Illustrations. Price* 6*s. net. Presented by the Publishers.*

Burton. **Dodge.**

The real Sir Richard Burton. By Walter Phelps Dodge. London: T. Fisher Unwin, 1907. Size 8 × 5½, pp. 240. *Portrait. Presented by the Author.*

Coillard. **Mackintosh.**

Coillard of the Zambesi: the lives of François and Christina Coillard of the Paris Missionary Society, in South and Central Africa (1858-1904). By C. W. Mackintosh. London: T. Fisher Unwin, 1907. Size 9 × 6, pp. xx. and 484. *Map, Portraits, and Illustrations. Price 15s. net. Presented by the Publisher.* [To be reviewed.]

Cook. **Kitson.**

Captain James Cook, R.N., F.R.S., "The Circumnavigator." By Arthur Kitson. London: John Murray, 1907. Size 9 × 5½, pp. xvi. and 526. *Maps, Portraits, and Illustrations. Price 15s. net. Presented by the Publisher.*

The first life of the great navigator based on trustworthy first-hand documents, and incorporating the results of the latest research. Many of the details in the generally accepted versions prove inaccurate.

Hawkins. **Walling.**

A sea-dog of Devon: a life of Sir John Hawkins. By R. A. J. Walling. London: Cassell & Co., 1907. Size 8½ × 5½, pp. xii. and 288. *Portrait. Price 6s. net. Presented by the Publisher.*

Historical—Goes. **Ribeiro and Vasconcellos.**

No centenario de Bento de Goes (1607-1907). Homenagem da Sociedade de Geographia de Lisboa, 11 de abril de 1907. I. Bento de Goes, por Augusto Ribeiro; II. O itinerario de Bento de Goes, por Ernesto de Vasconcellos. Lisboa, 1907. Size 10 × 6½, pp. 24. *Map and Illustrations.*

Sr. Vasconcellos hardly arrives at greater certainty in tracing the route across the Pamirs than did Yule (whose commentary on Goes, in "Cathay," does not seem to be known to either writer). He, however, takes the traveller by the valley of the Murghab (identifying "Serpanil" with the Sarez Pamir) instead of up the main valley of the upper Oxus.

Kant. **Gerland.**

Immanuel Kant, seine geographischen u. anthropologischen Arbeiten. Zwölf Vorlesungen von Dr. G. Gerland. Berlin: Reuther & Reichard, 1906. Size 9½ × 6½, pp. viii. and 174. *Price 3s. 9d.*

GENERAL.

British Empire. **Murray.**

Imperial Outposts from a Strategical and Commercial Aspect, with special reference to the Japanese Alliance. By Colonel A. M. Murray, with a preface by Field-Marshal Earl Roberts. London: John Murray, 1907. Size 9 × 6, pp. xxiv. and 210. *Maps and Illustrations. Price 12s. net. Presented by the Publisher.*

Early Travel. **Coryat.**

Coryat's Crudities, Hastily gobled up in five Moneths travells in France, Savoy, Italy, Rhetia, commonly called the Grisons country, Helvetia alias Switzerland, some parts of high Germany and the Netherlands; Newly digested in the hungry aire of Odcombe, in the County of Somerset, and now dispersed to the nourishment of the travelling Members of this Kingdome. By Thomas Coryat. 2 vols. Glasgow: J. MacLehose & Sons, 1905. Size 9 × 6, pp. (vol. 1) xx. and 428; (vol. 2) xii. and 436. *Facsimile Illustrations. Price 25s. net. Presented by the Publishers.*

Educational. **Simmonds and Richardson.**

An Introduction to Practical Geography. By A. T. Simmonds and Hugh Richardson. (New Edition.) London: Macmillan & Co., 1906. Size 7 × 4½, pp. xii. and 380. *Maps, Diagrams, and Illustrations. Price 3s. 6d.*; also in three sections, *price 1s. each. Presented by the Publishers.*

See review, *ante*, p. 207.

Educational—Text-book. **Herbertson.**

The Oxford Geographers, vol. 3. The Senior Geography. By A. J. Herbertson and F. D. Herbertson. Oxford: Clarendon Press, 1907. Size 7½ × 5, pp. viii. and 364. *Maps. Price 2s. 6d. Presented by the Publishers.*

The first two volumes were reviewed in the *Journal* for May last (vol. 29, p. 562). The present and concluding volume treats of the world from the point of view of its natural regions, which are made the basis of subdivision throughout. This is a novel, and the same time an eminently instructive, method.

See review, *ante*, p. 206.

Hints to Travellers. **Stigand.**

Scouting and Reconnaissance in Savage Countries. By Captain C. H. Stigand.

London: Hugh Rees, 1907. Size $6\frac{1}{2} \times 4$, pp. viii. and 144. *Charts and Diagrams. Price* 5*s. net. Presented by the Publisher.*

Useful practical hints to those desirous of acquiring "knowledge of country" in uncivilized lands, without burdening himself with scientific books or much knowledge of mathematics. They are the result of the personal experience of the author, gained while himself a learner.

Travel. **Keane and Reed.**

Bradshaw's through routes to the chief cities of the world, a comprehensive handbook of colonial and foreign travel. . . . Edited by Prof. A. H. Keane and Stanley Reed. London: H. Blacklock & Co., [*not dated*]. Size $6\frac{1}{2} \times 4\frac{1}{2}$, pp. xlviii. and 656. *Maps and Plans. Price* 5*s. net. Presented by the Publishers.*

Voyages. **Payne and Beazley.**

Voyages of the Elizabethan seamen. Select narrative from the 'Principal Navigations' of Hakluyt, edited by Edward John Payne, with additional notes, etc., by C. Raymond Beazley. Oxford: Clarendon Press, 1907. Size $7\frac{1}{2} \times 5$, pp. lxxii. and 416. *Maps and Illustrations. Price* 2*s.* 6*d. Presented by the Publishers.*

Year-Book. **Haack.**

Geographen-Kalender . . . herausgegeben von Dr. Hermann Haack. Fünfter Jahrgang, 1907. Gotha: J. Perthes, 1907. Size 6×4, pp. viii. and 776. *Maps and Portraits. Price* 5*s.* 6*d.*

There are several modifications and new features in this issue, adding still further to its usefulness.

Year-book. **Keltie and Renwick.**

The Statesman's Year-book. Statistical and historical annual of the states of the world for the year 1907. Edited by J. Scott Keltie, LL.D., with the assistance of I. P. A. Renwick. London: Macmillan & Co., 1907. Size 7×5, pp. xcvi. and 1672. *Maps and Diagrams. Price* 10*s.* 6*d. net. Presented by the Publishers.*

Among the sections which have received most radical revision are those relating to British West Africa and the armies of the various states, the latter having been entirely re-written by Major-General P. J. Maitland. The articles on the United States, both as a whole and separately, have also been carefully revised. Among the maps and diagrams illustrating current political events, is a series of the latter, by Mr. F. T. Jane, showing the comparative growth of the leading navies of the world.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from August 1 to 31, 1907.

4 miles to 1 inch:—

Diagrams, County showing Civil Parishes, with a table of their areas—Cardiganshire. *Price* 6*d.*

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Large-sheet series, printed in colours, folded in cover or flat in sheets, 8, 24. *Price, on paper,* 1*s.* 6*d.*; *mounted on linen,* 2*s.*; *mounted in sections,* 2*s.* 6*d. each.*

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Large-sheet series, printed in colours, folded in cover or flat in sheets, 16, 18, 20, 23. *Price, on paper,* 1*s.* 6*d.*; *mounted on linen,* 2*s.*, *mounted in sections,* 2*s.* 6*d. each.*

Small-sheet series, printed in colours, folded in cover or flat in sheets, 138. *Price, on paper,* 1*s.*; *mounted on linen,* 1*s.* 6*d.*; *mounted in sections,* 2*s.*
In outline, 90, 139, 346, 358. 1*s. each* (engraved).
With hills in brown or black, 79, 80, 88, 97, 109, 153, 154, 191, 351. 1*s. each* (engraved).

6-inch—County Maps (first revision):—

Carmarthenshire, 24 S.W., 30 S.E., 31 N.E., S.W., S.E., 32 N.W., S.W., 33 N.W., S.W., 34 N.W., S.W., 35 N.W., 38 N.E. **Cornwall**, 2 N.W., 4 N.E., 6 S.E., 12 N.W., 17 N.W., 23 N.E., S.E. **Devonshire**, 111 N.W., 124 S.E. **Lincolnshire**, 26 N.W., S.W., 27 N.W., 28 S.W., S.E., 29 N.W., N.E., 29 S.W., S.E., 35 N.W., 40 N.W., N.E., S.E. **Norfolk**, 65 N.E., 74 S.E., 89 S.W. **Pembroke**, 7 S.W. **Yorkshire** (First Revision of 1891 Survey), 251 N.E., S.E., 252 N.E., S.E., 264 S.E., 265 S.E., 271 S.E., 277 S.W., 280 N.W., N.E. 1*s. each.*

25-inch—County Maps:—

Cornwall (First Revision), XLVII. 15; L. 4, 11, 13, 14, 15; LI. 13; LVI. 4, 6, 9, 10; LVIII. 4, 5, 8, 11, 12; LIX. 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12; LX. 1 (13 and XLVI*a*. 1); LXV. 3, 10, 11, 14; LXXII. 2 (3, 4, and LXXII*a*. 1), 5 (7 and 11), 10. **Kent** (Second Revision), XXIII. 8, 10, 15; XXXV. 3; XLV. 6, 7, 11; LVIII. 14, 15; LXVII. 12, 16; LXVIII. 9, 10; LXXIII. 12, 16; LXXIV. 6, 7, 11, 12, 14, 15; LXXV. 5, 6, 9, 10, 11; LXXXII. 1 (2 and 6). 3*s. each.* **Lancashire** (First Revision of 1891 Survey), CII. 9, 10, 11, 12, 13, 14, 15, 16; CXI. 3; CXIV. 2, 3, 4, 6, 7, 8. 3*s. each.* CXI. 9; CXII. 3. 1*s.* 6*d. each.* **Lincolnshire** (First Revision), XIX. 5, 10, 14, 16; XX. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16; XXI. 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16. **Norfolk** (First Revision), LXXVI. 9; LXXVII. 6, 7; LXXXVIII. 2, 3; LXXXIX. 2. **Pembroke** (First Revision), IX. 10, 14; X. 9, 10, 14; XVI. 2, 3, 4, 6, 8, 10, 11; XVII. 1, 6, 9, 16; XXIII. 1; XXVIII. 5, 8, 9, 13; XXIX. 15; XXXIV. 7, 8, 11, 12, 15, 16; XXXV. 14; XL. 3, 4, 7, 8, 11, 12; XLI. 1, 2, 5, 6, 7, 8, 9, 10, 11, 15. **Yorkshire** (First Revision of 1891 Survey), CCXXIX. 2 (5 and CCXXIX*a*. 8), 6 (9 and CCXXIX*a*. 12), 10, 13, 14; CCXXXII. 3; CCXXXVI. 4, 8; CCXLIV. 2, 3; CCXLV. 1, 3, 4, 6, 7, 8; CCXLVI. 2, 3, 13. 3*s. each.* CCXXIX. 1; CCXLIV. 1, 7; CCLIV. 5; CCLVIII. 15; CCLXX. 3; CCLXXVIII. 4, 8. 1*s.* 6*d. each.*

(*E. Stanford, London Agent.*)

France. **Ministre de l'Intérieur, Paris.**

Carte de la France dressée par ordre du Ministre de l'Intérieur. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets: v.–14, Lannion; vii.–19, St. Nazaire; xi.–19, Angers; xii.–19, Saumur; xvii.–7, Arras; xvii.–31, Rodez; xx.–19, Avallon; xx.–24, Roanne; xxii.–33, Cavaillon; xxiii. 23, Oyonnax; xxiv.–24, St. Julien. Paris: Ministère de l'Intérieur, Service Vicinal, 1907. *Price* 0.80 *fr. each sheet.*

These are new editions.

Germany. **Wegemann.**

Veränderungen an der Küste des Kreises Hadersleben von ca. 1795 bis 1875. Von Dr. Georg Wegemann. Scale 1 : 75,000 or 1 inch to 1·2 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1907, Tafel 16. Gotha: Justus Perthes, 1907. *Presented by the Publisher.*

This chart of the east coast of Schleswig accompanies a paper by Dr. J. Wegemann. It indicates by different colours land that has been lost and gained on the coast from about 1795 to 1875.

ASIA.

Asia Minor. **Kiepert.**

Karte von Kleinasien. Bearbeitet von Dr. Richard Kiepert. Scale 1 : 400,000 or 1 inch to 6·3 stat. miles. Sheet B. III., Angora. Berlin: Dietrich Reimer, 1907. *Price* 6*m. each sheet.*

This sheet includes the region lying approximately between lat. 39° and 40° 40′ N and long. 31° and 33° 45′ E. The great task undertaken by Dr. R. Kiepert is now rapidly drawing near to a close, and only one more sheet remains to be published in order to complete this map.

Ceylon. **Surveyor-General, Ceylon.**

Ceylon. Scale 1 : 506,880 or 1 inch to 8 stat. miles. Published under orders of Mr. P. D. Warren, F.R.G.S., Surveyor-General of Ceylon. Colombo: Survey Department, 1907.

A new edition of a small general map of Ceylon without any attempt to indicate relief. Roads, railways, telegraphs, boundaries of provinces, etc., are shown by symbols and colours. Several such maps of the island have been published in the past, but what is wanted is a really good geographical map on modern lines, with physical features carefully shown.

Persia. **Stahl.**

Geologische Routenkarte von Zentral-Persien nach eigenen Aufnahmen von A. F. Stahl. Blatt I. u. II. Scale 1 : 840,000 or 1 inch to 13·2 stat. miles. *Petermanns Mitteilungen*, Jahrgang, 1905. Tafeln 14 u. 15. Gotha: Justus Perthes, 1907. *Presented by the Publisher.*

To accompany the author's account of his geological and route surveys in Central and North-West Persia, published in the August number of *Petermanns Mitteilungen*. Sheet 14 includes the country traversed between Kum and Isfahan and from Isfahan to Hamadan; while sheet 15 gives the continuation to north, and passes by way of Maragha and Lake Urmia to Tabriz, and thence east to Astara on the Caspian. The geology is indicated by colouring.

AFRICA.

Africa. **Topographical Section, General Staff.**

Map of Africa. Compiled in the Topographical Section, General Staff. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. Sheets: 45, Dongola and Berber; 46, Suakin; 55, Khartum; 66, White Nile and Sobat. *Price 2s. each.* Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Sheet 86—J, Uganda. *Price 1s. 6d.* London: Topographical Section, General Staff, War Office, 1907. *Presented by the Director of Military Operations.*

British Central Africa. **Topographical Section, General Staff.**

Map of British Central Africa. Compiled in the Topographical Section, General Staff. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. London: Topographical Section, General Staff, War Office, 1907. *Price 4s. 6d. Presented by the Director of Military Operations.*

Compiled chiefly from the recent official surveys and traverses made under the direction of Mr. T. I. Binnie, the director of public works in British Central Africa. The outline of the lake and its soundings are from the surveys of Lieut. E. L. Rhoades, as laid down on the map published in the *Geographical Journal* for July, 1902. In the northern part the work of the Anglo-German Boundary Commission has been utilized. The map is printed in colours, and forms part of the 1 : 1,000,000 map of Africa now being prepared by the Topographical Section of the War Office.

Gold Coast. **Guggisberg.**

Map of the Gold Coast. Published by the authority of Sir John Pickersgill Rodger, K.C.M.G., Governor, under the direction of Major F. G. Guggisberg, R.E., F.R.G.S., Director of Surveys, Gold Coast. Scale 1 : 125,000 or 1 inch to 1·9 stat. miles. Sheet 72 R II., Accra. Edinburgh and London: W. & A. K. Johnston, 1907. *Price 2s. each sheet. Presented by Major F. G. Guggisberg, R.E., Director of Surveys, Gold Coast.*

This is another sheet of the new map of the Gold Coast, which was noticed in the *Geographical Journal* for June last. The area included is from lat. 5° 30′ to 6° 0′ N., and from long. 0° to 0° 30′ W. It thus extends from Accra on the coast to over 30 miles inland. Much remains to be filled in on later editions, and a considerable amount of the information here given, away from the traverses and route-surveys from which the sheet has been chiefly compiled, is very approximate. Still, this is a great advance on any map of the district that has hitherto appeared. Hills are shown by brown shading, and the same colour has been used to indicate boundaries, which is to be regretted, since it tends to confusion, specially when the lines cross the hills. A complete table of reference to symbols and conventional signs is given at the side of the sheet, as well as a useful note on the system of orthography.

Tunis. **Service Géographique de l'Armée, Paris.**

Carte de la Tunisie. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheet LXI. Senend. Paris: Service Géographique de l'Armée. *Price 1.20 fr. each sheet.*

AMERICA.

Brazil. **Cardoso.**

Carta de Progresso da Commissão Geographica e Geologica de S. Paulo. João Pedro Cardoso, Chefe. Scale 1 : 2,000,000 or 1 inch to 31·6 stat. miles. S. Paulo: Directoria de Industria e Commercio. *Presented by the Directoria de Industria e Commercio.*

An outline map showing, in addition to chains of triangles, areas where coffee is grown, which are tinted green.

Canada. **Anderson.**

Telegraph Chart of the Gulf and Lower St. Lawrence and Maritime Provinces.

Compiled by Lieut.-Colonel Wm. P. Anderson, M. INST. C.E., F.R.G.S., Chief Engineer, Department of Marine and Fisheries, Canada. Scale 1 : 2,000,000 or 1 inch to 31·6 stat. miles. Revised to May 1, 1907. Ottawa: Department of Marine and Fisheries, 1907. *Presented by Lieut.-Colonel W. P. Anderson.*

This chart contains a large amount of information that cannot fail to be of the greatest value to all who are concerned with the navigation of the Maritime Provinces of Canada and the Gulf of St. Lawrence. In addition to telegraph lines, existing and projected, and ordinary tracks of vessels, it shows, by clearly defined symbols, electro-signal stations in operation in accordance with the international code of signals, existing telegraph stations, wireless telegraph stations under control of the Marine Department, lighthouses, storm signals, besides tables of distances and the rules and regulations governing the marine signalling stations, which are printed on the map as notes. No attempt has been made to indicate soundings.

Canada. **Dept. of the Interior, Ottawa.**

Sectional map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheets: 10, Port Moody, revised to July 15, 1907; 11, Yale, revised to April 27, 1907; 16, Milk river, revised to June 25, 1907; 61, Lytton, revised to May 14, 1907; 66, Medicine Hat, revised to July 9, 1907; 67, Maple Creek, revised to July 17, 1907; 111, Kamloops, revised to May 15, 1907; 263, Jasper, revised to May 29, 1907; 320, Carrot river, revised to June 11, 1907. Ottawa: Dept. of the Interior, Topographical Surveys Branch, 1907. *Presented by the Department of the Interior, Ottawa.*

Honduras. **Mayes.**

Mapa de la Republica de Honduras. Levantado por E. P. Mayes, I.C. Scale 1 : 530,000 or 1 inch to 8·4 stat. miles. Chicago and New York: Rand, McNally, & Co., 1907. *Price $3.00. Presented by the Publisher.*

The material for constructing a map of the Republic of Honduras is, for the most part, of a very approximate and sketchy character, but it is to be regretted that the author of this map has not made use of such information as is available. For instance, the important work of Dr. Karl Sapper has received but scant attention, and in the north-eastern region his survey of the course of the river Coca has been entirely ignored, this river being merely sketched in the roughest possible manner, and shown as following an entirely wrong course. In some parts the map shows a fair amount of information, including railways, working and proposed, roads, telegraphs, and gives heights from barometric readings.

GENERAL.

World. **Harmsworth.**

Harmsworth Atlas and Gazetteer. 500 maps and diagrams, and 105,000 references. Part 20-23. London: The Amalgamated Press, Ltd., 1907. *Price 7d. each part.*

These parts contain the following maps: Part 20, Nos. 23-24, South of England railway systems; 95 96, Russia in Europe and the Caucasus; 173-174, Southern United States. Part 21, Nos. 21-22, North of England and South Scotland railway systems; 77-78, Eastern Spain; 159-160, Maritime Provinces of Canada and Newfoundland. Part 22, Nos. 29-30, Northern England; 69-70, Austria and Western Hungary; 139-140, West Africa. Part 23, Nos. 93-94, Denmark with Schleswig-Holstein; 109-110, Central Asia; 187-188, South America (industries and communications).

Charts.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during July, 1907. *Presented by the Hydrographer, Admiralty.*

New Charts.

No.	Inches.	
1543 m	= {1·7, 17·3}	England, east coast:—Yarmouth and Lowestoft roads, Yarmouth haven, Lowestoft harbour. 4s.
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3619 m	= 1·8	British Columbia:—Moresby passage to Gabriola pass, southern sheet. 3s.

No.	Inches.	
205 m	= 4·0	Plans in the Red sea:—Mersa Fejer, Mersa Darúr, Mersa Kilhai. 2s.
22 m	= 0·5	Persian gulf:—Kuweit harbour and approaches. 2s.
3662 m	= var.	Philippine islands. Plans on the north-west coast of Luzon:—Port San Esteban and Nalvo bay, Santiago cove, Darigayos inlet, Solvek cove. 2s.
1961 m	= 0·7	Formosa, west coast:—Pescadores islands. 3s.
3652 m	= 1·0	Korea, west coast:—Amunyoku kan (Yalu river). 3s.
3650 m	= 1·9	Japan, Honshu (Nipon), south coast:—Toba ko. 2s.
1175 m	= var.	South Pacific ocean. Sketches of anchorages in the Tuamotu or Low archipelago:—Ahii or Peacock island, lagoon entrance, Manihi entrance. Tokea or Takaroa, lagoon entrance. Amyot bay, Avatoru entrance, Tiputa entrance. Mururoa or Osnaburg island. North passage to Rotoava. Fakahina island. Passes into Amanu atoll. Pakaka (Aniuru) pass. Pakaka to Seignelay point. 2s.
3664 m	= {7·2, 5·2}	South Pacific ocean. Passes and anchorages in Tuamotu or Low archipelago:—Raroia pass and anchorage. Makemo island, north-east pass and anchorages. Tahanea island passes. 3s.

New Plans and Plans added.

3346 m	= 3·7	Germany:—Jade and Weser rivers. New Plan:—Bremen docks. 4s.
1832 m	= 11·0	Plans of anchorages in the Grecian archipelago. Plan added:—Tinos harbour. 2s.
1302 m	= 3·5	Plans on the coast of Chile. New plan:—Arica road. 2s.
932 m	= var.	Eastern archipelago:—Surabaya, Bali and Japudi straits, etc. New plans:—Bali strait, Temukus (Tebunkus) road, Saugsit road, Bunkulau road, Ambat (Chulik) road. 3s.
2195 m	= {7·0, 1·4}	Sketch-plan of anchorages in the eastern part of the Celebes. New plans:—Bualemo road, Banano road, Posso road, Tojo (Taliboi) road, Ampat islands anchorage, Banta road, Mapane road, Tambu bay. Plans added:—Sabo road, Balingara road, Tobelombangi road, Ampibabo road. 2s.
1026 m	= 7·0	Australia, east coast. Solitary islands and adjacent coast. Plan added:—Coffs harbour. 3s.

Charts Cancelled.

No.	Cancelled by	No.
1543 England, east coast:—Yarmouth and Lowestoft roads, Yarmouth haven, Lowestoft harbour.	New chart. Yarmouth and Lowestoft roads, Yarmouth haven, Lowestoft harbour	1543
3029 British Columbia:—Active pass to Gabriala pass and inner channels. 714 British Columbia:—Harbours and anchorages in Stuart and Trincomalie channels: Oyster and Telegraph harbours, Maple bay, Osborn bay.	New chart. Moresby passage to Gabriola pass, northern sheet (published in June) . . New chart. Moresby passage to Gabriola pass, southern sheet	3618 3619
645 Africa, east coast:—Port Melville.	— — — —	
81 Red sea:—Mersa Durúr to Trinkitat. Plan of Mersa Durúr on this sheet.	New chart. Mersa Durúr on sheet	205
22 Persian gulf:—Kuweit harbour.	New chart. Kuweit harbour and approaches . . .	22
1961 Formosa, west coast:—Pescadores islands.	New chart. Pescadores islands	1961
952 Japan:—Owasi bay to Takamatsu no saki, etc. Plan of Toba anchorage on this sheet.	New chart. Toba ko	3650

No.		Cancelled by	No.
1175	Sketches of anchorages in the Tuamotu or Low archipelago.	New chart. Sketches of anchorages in the Tuamotu or Low archipelago	1175

Charts that have received Important Corrections.

No. 1859. England, west coast:—King road. 355*a*, United States, east coast:—Chesapeake bay. 1496, Bahamas: Great Bahama bank, sheet I. 2077, Bahamas, sheet IV.: from Exuma to New Providence. 2431, Alaska:—Port Simpson to Cross sound. 2458, Alaska:—Port Simpson to Port McArthur. 3252, Central Africa:—Victoria Nyanza, northern portion. 755, Bay of Bengal:—False point anchorage. 1388, Pescadores islands:—Inner anchorages. 1798, China, north coast:—Kwang-tung peninsula, etc. 2833, China, north coast:—Port Adams, Hulu shan bay. 997, Japan:—Yokoska harbour. 952, Japan:—Owasi bay to Takamatsu no saki. 3565, New Zealand:—Bream head to Tepaki point. 214, Solomon islands.

(*J. D. Potter, Agent.*)

Chile. **Oficina Hydrografica, Valparaiso.**

Chilian Hydrographic Chart. No. 125, Canal Chiguao. Valparaiso: Oficina Hydrografica, 1906. *Presented by the Chilian Hydrographic Office.*

Indian Ocean and Red Sea. **Meteorological Office.**

Monthly meteorological chart of the Indian ocean north of 15° S. lat. and Red sea, September, 1907. London: Meteorological Office, 1907. *Price 6d. each. Presented by the Meteorological Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Monthly meteorological chart of the North Atlantic and Mediterranean, September, 1907. London: Meteorological Office, 1907. *Price 6d. each. Presented by the Meteorological Office.*

North Atlantic. **U.S. Hydrographic Office.**

Pilot chart of the North Atlantic ocean, September, 1907. Washington: U.S. Hydrographic Office, 1907. *Presented by the U.S. Hydrographic Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot chart of the North Pacific ocean, September, 1907. Washington: U.S. Hydrographic Office, 1907. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Bhutan. **White**

Album containing forty photographs of Bhutan. By J. C. White, Esq., C.I.E., and others. *Presented by the Government of India, through India Office.*

An excellent series of enlargements of photographs taken during the recent British expedition through Bhutan from Dewangiri to Gyangtse. The route to a great extent is new, which fact gives to the views a special value.

(1) Sir Ugyen Wang Chuk, Tongsa Penlop; (2) Paro Jong from the right bank of the Par Chhu; (3) Larger central tower, Paro Jong; (4) Paro Jong from the south-east; (5) Paro Jong from camping-ground on the right bank; (6) The musicians of the Paro Jongpen; (7) A Chuten near the monastery of Gorina; (8) Duk-gye (Domgit) Jong; (9) Tashichhu Jong; (10) Mendong (prayer wall) dividing monastic from lay quarters, Tashichhu Jong; (11) Interior of main courtyard, Tashichhu Jong; (12) Abbot of the Tatshang Lamas at Tashichhu Jong; (13) Punakha from the right bank of the Po Chhu; (14) Punakha from the Mo Chhu; (15) Durbar held when the Tongsa Penlop was presented with the insignia of the K.C.I.E.; (16) The Deb Raja; (17) Bhutan council; (18) Sole entrance of Angduphorang Jong; (19) Interior of second court, Angduphorang; (20) First court, Angduphorang Jong; (21) Village of Tongsa; (22) Tongsa Jong as seen from above; (23) Tongsa Jong; (24) Interior of Tongsa Jong; (25) Tongsa Penlop and family; (26) Interior of middle court, Tongsa Jong; (27) Monastic dancers at Tongsa Jong; (28) Devil dancers, Tongsa Jong; (29) Musicians of Tongsa Penlop; (30) Lamas' quarters, Tongsa Jong; (31) House near Bya-gha; (32) Interior of Kuje-Lhakhang, with hole supposed to have been caused by the reclining of the first Guru Rimpoche; (33) Chuten built on Nepalese model between Tongsa and Bya-gha; (34) The Tongsa's bodyguard; (35) Mr.

C. White, Sir Ugyen Wang Chuk, Major Rennick, Mr. Paul; (36) Bhutanese coolies being fed after arrival in camp; (37) Tongsa Penlop's sister's family; (38) Gorge beyond Lingzi Jong towards the borders of Tibet; (39) Bridge over the Wong Chhu at Tashichhu Jong; (40) The Tongsa Penlop's medical attendant, a Lama from one of the Lhasa monasteries.

British and German East Africa. **Dickinson.**

Seventy-three photographs of British and German East Africa, taken by Captain F. A. Dickinson, Duke of Cornwall's Light Infantry. *Presented by Captain F. A. Dickinson.*

Many of these are game subjects, but, as a whole, they give a good idea of the character of the country. They were taken by Captain Dickinson during a visit paid by him about two years ago.

(1) Vasco da Gama's old fort at Mombasa; (2) Travelling over the plains; (3) The upper waters of the Guaso Narok; (4) Camp at the junction of the Northern Guaso Nyiro and Guaso Narok; (5) The junction of the Guaso Narok and Guaso Nyiro; (6) Anglo-German Boundary Commission camp in the Guaso Nyiro; (7) Curious outcrop of basaltic rocks across the valley of the Guaso Narok; (8) The Pesi swamp; (9) The Marakwa river; (10) Bridge over the Marakwa river; (11) Crossing the Marawka river; (12–14) Near Nairobi; (15) Forest near Nairobi; (16 and 17) View under Mount Erok; (18–20) Masai El Moran; (21) Masai warriors in their war-paint; (22) Masai cattle; (23) Lo Dogolani sub-tribe of the Masai; (24) My guide, philosopher, and friend, a Lo Dogolani Masai; (25) The swing-bridge over the Thika-Thika river; (26) The Thika-Thika river; (27) Camp on Mount Kilibei; (28) A Wandorobo village; (29) Wandorobo hunters eating raw ribs of rhino; (30) The Tana river; (31) The temporary ferry over the Tana river; (32) Cattle crossing the Tana river; (33) The Nandi forest; (34) Soba station, Nandi country; (35) A sub-section of the Nandi at Soba station; (36) Umbrella thorn tree; (37 and 38) On the Laikipia Escarpment; (39) In the Great Rift Valley near Lake Natron; (40) A three weeks' shoot near Lake Natron; (41) After a buffalo hunt in a swamp near Lake Natron; (42) A swamp under Kilimanjaro; (43 and 44) Kilimanjaro; (45) An outcrop of granite rocks on the vast plain under Kilimanjaro; (46 and 47) Lesser kudu; (48) Wildebeeste; (49 and 50) Cape buffalo; (51) Zebra; (52) Zebra at Naivasha farm; (53 and 54) Oryx beisa; (55 and 56) Impallat; (57) Hen ostrich; (58) Cock ostrich; (59 and 60) Fringe-eared oryx; (61) Hartebeeste; (62) Grant's gazelle; (63 and 64) Waller's gazelle; (65) Roan antelope; (66) A barbel out of the Tana river, forty-six and half pounds; (67) Hartebeeste; (68) Rhinoceros; (69) Lion; (70) Thomson's gazelle; (71) Roberts' gazelle; (72) Waiting for a big-game drive; (73) A month's shoot on the Anglo-German boundary.

Canada. **Adam.**

Nineteen photographs of Canada, taken by Frank Adam, Esq. *Presented by Frank Adam, Esq.*

Some of these prints are from snap-shots taken from a train while in motion, passing though the Rocky mountains. Six of them are panoramas.

(1 and 2) Bison in the National Park, Banff; (3) View near Banff; (4) Bow river, Banff; (5–9 and 14–16) Snap-shots, from moving train, among the Rockies; (10) Snap-shot, taken from rear of train, of front of train rounding a curve in the Rockies; (11 and 17) The Selkirk mountains; (12) The upper Arrowhead lake; (13) The lower Arrowhead lake; (18) Nelson Kootenay; (19) View near Banff.

Ceylon. **Varley.**

Eleven photographs of Ceylon, taken by F. J. Varley, Esq. *Presented by F. J. Varley, Esq., M.A.*

Mr. Varley, who has at various times presented many interesting photographs of India to our collection, has now added the following set of small views taken recently in Ceylon.

(1) The Moonstone, Anuradhapura; (2) Ruined Buddhist temple, Anuradhapura; (3) Buddhist dagoba, Anuradhapura; (4) Ruined dagoba, overgrown with jungle, Anuradhapura; (5) Colossal image of Buddha in stone, Anuradhapura; (6) The sacred Bo tree and stone image of Buddha, Anuradhapura; (7) The oldest Buddhist temple in Anuradhapura; (8) Entrance to the old Dutch fort, Jaffna; (9) The moat and bastions, Jaffna; (10) Walls of the fort, Jaffna; (11) The umbrella tree of South India and young Palmyra palms.

China and Japan. **Harfeld.**

Forty-nine photographs of China and Japan, taken by Captain F. Harfeld, R.H.A. (Attaché au Cabinet du Roi, Bruxelles). *Presented by Captain F. Harfeld.*

These photographs were taken by Captain F. Harfeld during his journeys, extending over four years, in the provinces of Hu-nan and Kuang-tung, and in Japan. They are all interesting, and form a welcome addition to the Society's collection. The following list of titles gives particulars:—

(1) Cormorant fishing on the Hsiang river; (2) Junks on Hsiang river; (3) Confucius temple in Chang-sha; (4) Courtyard of a farm in Tung-yang; (5) A Chinese inn near Tung-yang; (6) Graves near I-yang; (7) Theatrical performance in the open air, near Chang-tê; (8) A Chinese inn near Chang-tê; (9) Interior of a Chinese inn at Chan-chou; (10) Granite quarries at Ta-fu-shih; (11) Gold-washing at Yukatson; (12) Hu-nan people near Chang-sha looking at a foreigner; (13) People of Li-chou, on the 660-foot bridge over the southern Li; (14 and 15) Characteristic view of the country between Bemado and Kei-ting-hsi: (16) Rafts on the Yüan Chiang; (17) A Chinese gunboat on the Yüan Chiang; (18) A pagoda near Shanghai; (19) A creek at Chang-an; (20) Old pagoda near Su-chou; (21) Bridge over a creek near Fati; (22) Malans and other boats in a creek near Honam; (23) Raft and bridge near Fati; (24) A creek near Fêng-chuan; (25) Brick-kilns near Canton, coolie using the noria; (26) Brick-kilns; (27) Flower-boat on the West river; (28) Right bank of the West river near Fêng-chuan; (29) A corner of Honam island; (30) A temporary theatre in southern Kuang-tung near Fa-shan; (31) Breeding ducks near Fati; (32) Funeral boat, Canton river; (33) Inside view of a malan with an Akka family; (34) A pawnshop; (35) Characteristic view of the river near Wang-sha; (36) The dragon boat festival on the Canton river; (37) Paintings on a junk; (38) Steamer being towed on the West river near Wu-chou; (39) The junks towing the steamer on the West river near Wu-chou; (40) Hills and temple near Wu-chou; (41 and 42) Temple near Wu-chou; (43) The Bay of Macao; (44) The ruins of St. Paul's, Macao; (45) Camoens' monument, Macao; (46) Cryptomeria's lane near Nikko; (47) One of the temples, Nikko; (48) The Buddha's lane; (49) Waterfall near Myamoshita.

Northern Nigeria. **Edwardes.**

Seventy-five photographs of Nupe Province, Northern Nigeria, taken by H. S. W. Edwardes, Esq. *Presented by H. S. W. Edwardes, Esq.*

Although small, some of these are specially interesting, and in years to come will have a considerable historical importance. The titles are as follows:—

(1) General scenery near a town; (2) View at Kutigi; (3) A young Nupe girl; (4) Roofing a hut; (5) Dyeing; (6) Load of kola resting on a "loko" whilst carrier feeds; (7) Joe, my steward, and freed slave boy; (8) Braima interpreter; (9) A fish-trap on the Kaduna river; (10) Carriers on the march; (11) An ant-heap; (12) Outside residency, Bida; (13) Caravans outside walls of Bida; (14 and 15) Bida toll station; (16) Gate, Bida, since removed to make way for road; (17) Returning from the levee, Bida; (18) The Munshi Expedition in camp; (19) The Munshi Expedition, the officers; (20) The Munshi Expedition on the march; (21) The Munshi Expedition resting; (22) An old slave; (23) Natives at Dakmon; (24) Natives at Jimunli; (25) The Kaduna river at Dakmon; (26) Near Jimma; (27) Jimma; (28) An old labourer; (29) Typical country; (30) A Nupe loom; (31) President Goldsmith proceeding on tour; (32) Encouraging labourers; (33) In Bida main street; (34) A market, Bida; (35) Girls bringing loads of produce to Bida; (36) My survey station; (37) The Emir's palace, Bida; (38) Market scene, Bida; (39) A fetish man with jujus on mat; (40) Bringing water; (41 43) The tennis-court; (44) A flood; (45) The Chingi ferry; (46) My team of carriers; (47) Mr. Edwardes about to swim flooded river; (48) Large male baboon shot in Bongba district; (49) Road-making, clearing the ground; (50) Road-making, women bringing earth for an embankment; (51) Road-making, bridging a nullah; (52) Bako river; (53) Bako ferry; (54) Tobacco near Bisatti; (55) Canoe being cut out of a large log; (56) Native-made embanked road; (57) Bungalow, Bida; (58 and 63) Jebba, the ju-ju rock; (59) Fulani hut, showing calabashes; (60) Kede village on the Niger; (61) Ferry across flooded river; (62) A big Nupe slave; (64) The Emir's court; (65) An old warrior; (66) A Nupe boy; (67) The ostrich of the Nakworiji of Bida; (68) A herd of Fulani cattle; (69) Fulani women dressing their hair; (70) "Kaura," the favourite of the Emir of Bida; (71) Dove-cote; (72) A Nupe girl; (73) Two Fulani girls; (74) A native interpreter; (75) Group of Nupe headmen.

Tibet. **White.**

Two albums containing eighty-five photographs of Tibet and Lhasa, taken by

J. C. White, Esq., C.I.E. Calcutta: Johnston & Hoffmann. *Presented by the Government of India, through the India Office.*

These two valuable albums of photographs are enlargements from negatives taken by Mr. J. C. White, C.I.E., the political officer attached to the recent British expedition to Lhasa. The exceptional circumstances of this expedition, and the fact that a great part of the route was new, and is likely to remain closed again to Europeans for years to come, give a special value to the series, and the Society's collection has been greatly enriched by this presentation. Mr. White, who is a good photographer, evidently made the most of his opportunities, and these excellent views are eminently characteristic of the country and people. Some of the panoramas are very fine. The sizes vary from 7¼ × 12½ to 10¼ × 45½ inches.

(1) The river Tista; (2) The source of the Tista; (3) A glacier lake; (4–6) Kham-pa-jong; (7) Mount Everest from Kham-pa-jong; (8) Group of nuns; (9) The abbot at Kham-pa-jong; (10) Panorama of Kham-pa-jong; (11) Chongu; (12) Na-thö La from Cham-pi-thang; (13) Chomolhari from Cham-pi-thang; (14) The Mo-chu river; (15) Chorten near Rin-chen-gong; (16) Phema village; (17) Bridge at Phema; (18 and 19) Pha-ri Jong; (20) Samuda; (21) Kang-mar; (22) Yaks in Ekkas; (23) Gyang-tse Jong; (24) The Gurkha post; (25) The mission post at Gyang-tse; (26) Nishi-kang Sang; (27) Nishi-kang Sang glacier; (28 and 29) Views near camping-ground a few miles beyond Kha-ru La; (30) Sam-ding monastery; (31) Pa-de Jong; (32–34) View of the Yam-dok-tso; (35) The Tsang-po or Brahmaputra valley; (36) Panorama of Tsang-po valley; (37 and 38) Chak-zam ferry; (39–41) The old disused iron chains from which hung the bridge, Chak-zam ferry; (42–45) Views up the Kyi-chu valley; (46) Shing-dong ka; (47) Tö-lung bridge; (48) Dre-pung monastery; (49) A group of Lamas of Dre-pung monastery; (50) An image in one of the Gon-pas of Dre-pung monastery; (51–54) Nai-chung monastery; (55 and 56) The astrologer's summer residence; (57) Sera monastery; (58) Street scene in Sera monastery; (59) The two stewards and senior Lamas of Sera monastery; (60) The Lha-la house; (61) The entrance to Lhasa; (62) The Chorten, looking backwards, or to the west from the foot of the Po-ta-la; (63) The so-called turquoise bridge; (64) A street scene in Lhasa; (65) A "do-ring" or monument outside the Jowo Khang; (66) The Lukhang; (67) The chogpiri, or medical school; (68) The Ling-kor, or sacred circular road to Lhasa; (69–78) The Po-ta-la; (79) View of a grove near Lhasa; (80) The regent; (81) The Sha-pes; (82) Tongsa-Penlob and his retinue; (83 and 84) The Chinese Amban; (85) Panorama of Lhasa.

Yün-nan. **Young.**

Seventeen photographs taken during a journey from Yün-nan to Assam, by E. C. Young, Esq. *Presented by E. C. Young, Esq.*

Mr. Young's paper describing the journey upon which these photographs were taken was published in the *Geographical Journal* for last August. A great part of the route was previously very little known, hence these views have an exceptional interest. Some of them are very good, and most typical of the country.

(1) Valley of the Mekong looking south from near Fei-lung-ch'iao; (2) Fei-lung-ch'iao suspension bridge over the Mekong; (3) River Salween, above Lu-kou; (4) Liso village of Tsa-mi-ti in the Salween basin; (5) Liso in fighting-dress; (6) View of the Salween valley, in the Ulu-lama country; (7 and 9) Group of Ulu-lamas in the Salween valley; (8) Ulu-lama woman spinning yarn; (10) River Nmai Hka, our party crossing in a dugout; (11) Village scene in the valley of the Nmai Hka; (12) Tomb of a Singplo headman, Mali Hka basin; (13) House of the headman or Chowpa of Langnu in the Hkampti district; (14) River scene near Langnu; (15) Scene in Langnu; (16) Wife, daughters, and grandchild of the Chowpa of Langnu; (16) The Chowpa of Langnu.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Cu ator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

RUSSIAN CENTRAL ASIA
RICKMERS.

THE GEOGRAPHICAL JOURNAL 1907.

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J. G. Bartholomew

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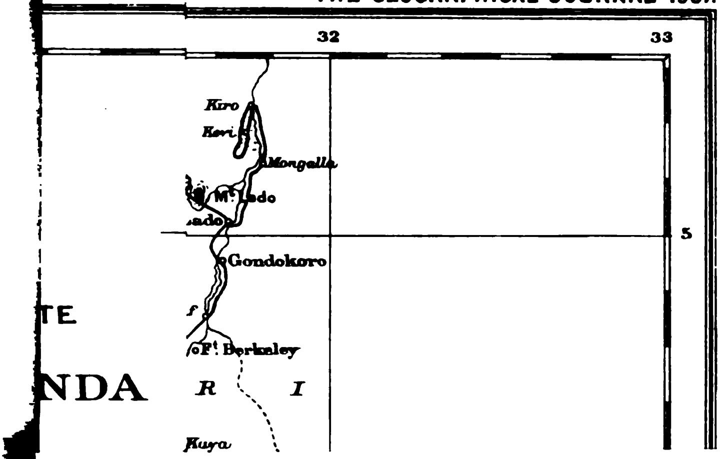
THE GEOGRAPHICAL JOURNAL 1907.



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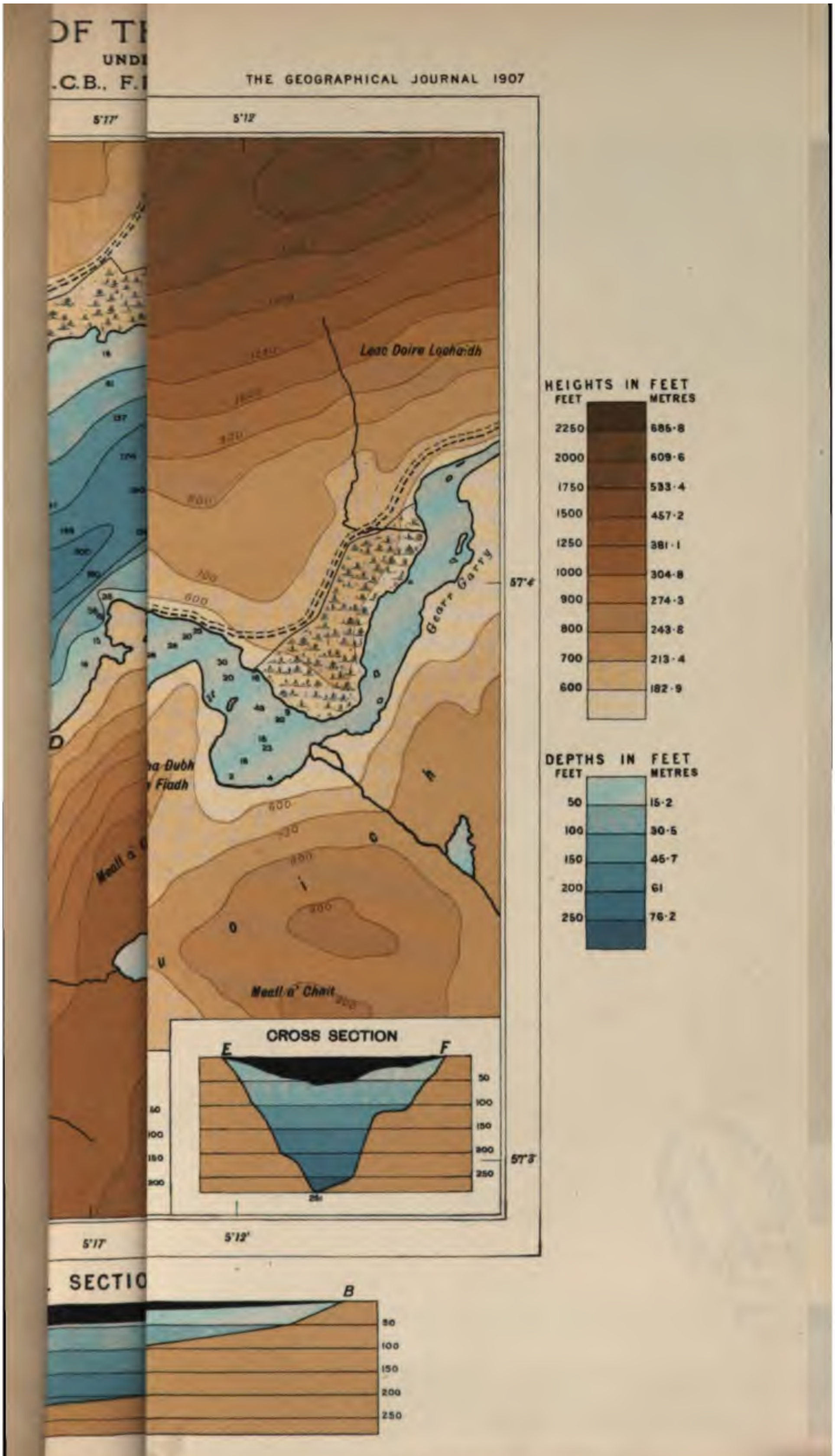

J. G. Bartholomew


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PLATE VIII

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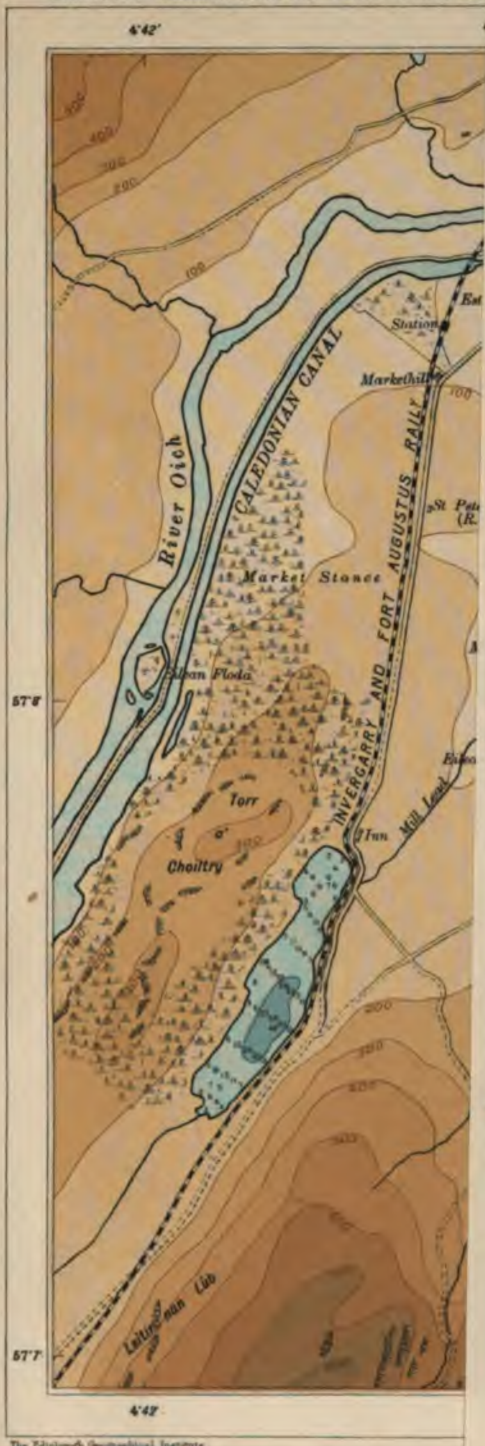

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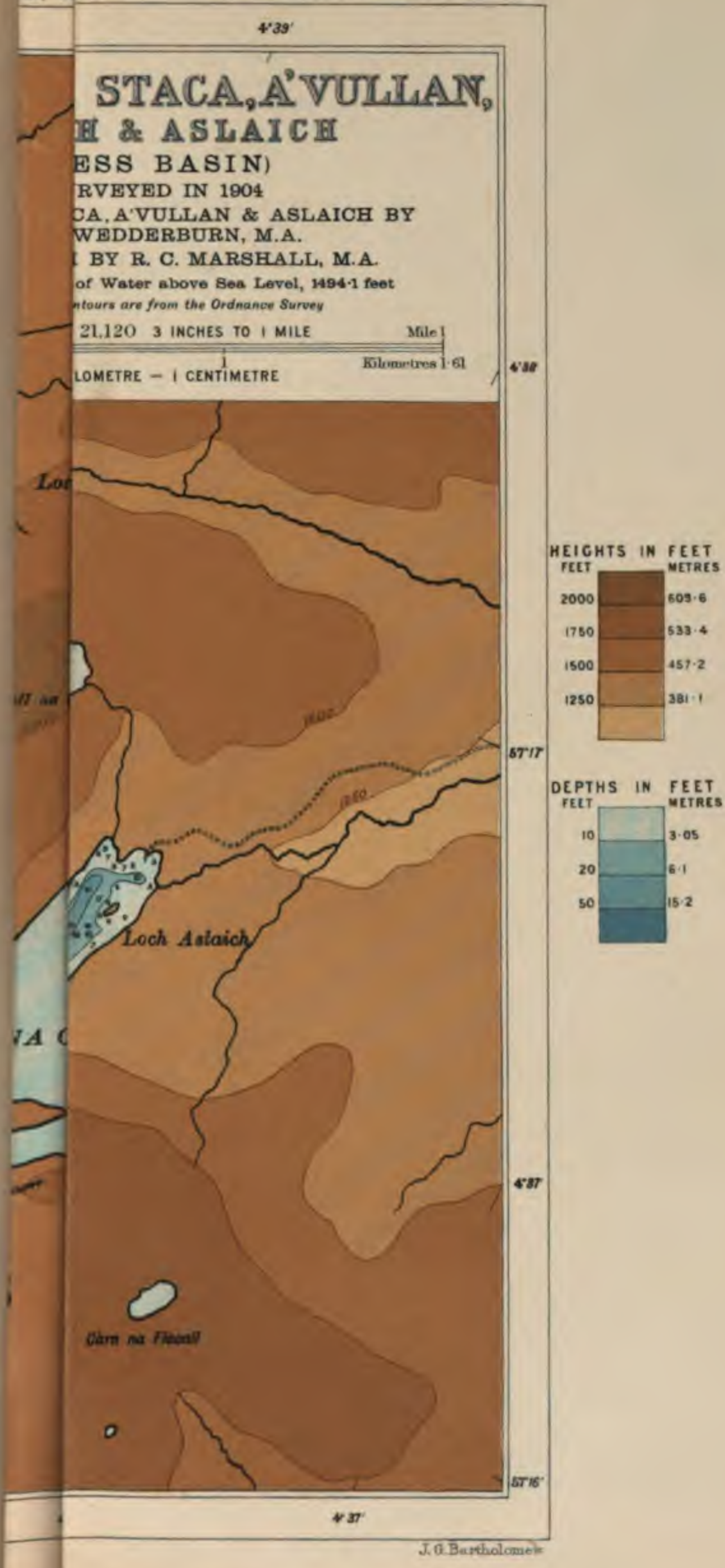
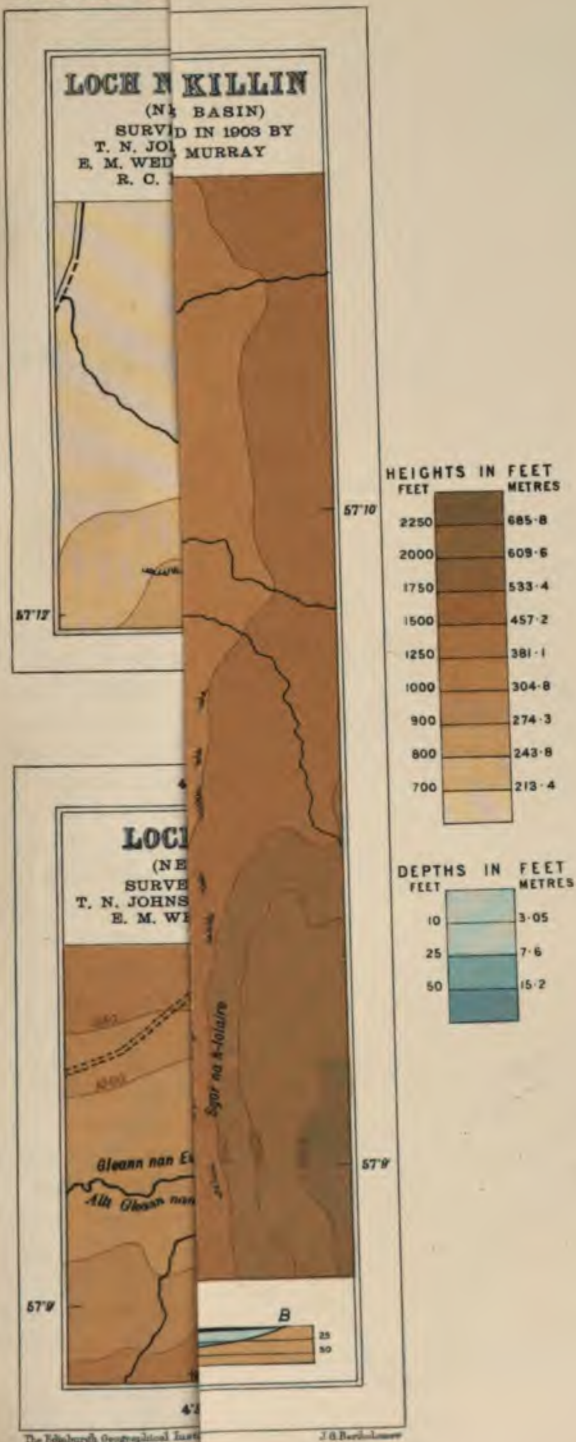


J. G. Bartholomew

PLATE XII



The Edinburgh Geographical Inst
J.G.Bartholomew

The

Geographical Journal.

No. 5. NOVEMBER, 1907. Vol. XXX.

ON NORTH POLAR PROBLEMS.*

By Dr. FRIDTJOF NANSEN.

A YEAR and a half ago our late distinguished President, Sir Clements Markham, read before our Research Department a most interesting paper,† treating more or less of the same subject which I am going to discuss to-night; and the paper was followed by an important discussion. To my great regret, I was unable to be present on that occasion. Although it might seem unnecessary to take up this subject so soon again for fresh consideration, I have nevertheless been asked to do so, evidently because a full discussion of this matter is considered to be important for the future exploration of the still Unknown North. Perhaps it was also hoped that I might be able to throw some new light upon the many difficult questions. Although I fear that I shall not be able to justify such bold expectations, I thought I could not refuse the kind request, considering that I have given some part of my life to the study of these questions; and I am glad to use this opportunity to sum up some of the conclusions to which my researches have led me.

The present paper was originally intended to deal with both North Polar and South Polar problems; but I soon saw that if the discussion should be in any way satisfactory, it would be necessary for the present to limit ourselves only to the North Polar problems, following the maxim which I think ought to be the maxim of all polar exploration of the future: do not try to do too much, but that which you do, try to do it thoroughly well. I cannot, therefore, even promise to take up for consideration here to-night all North Polar problems; I shall have to limit myself to those which I consider to be of most importance.

* Read at the Royal Geographical Society, April 29, 1907. Map, p. 584.

† Clements Markham, "On the Next Great Arctic Discovery," *Geographical Journal*, vol. 27, 1906, p. 1.

On many and essential points I fully agree with the views set forth by my venerated friend Sir Clements Markham in the above-mentioned paper, whilst on others we differ somewhat. Many of his conclusions have been based on the discoveries of the *Fram* Expedition across the North Polar basin, and on the descriptions and discussions of our observations given in some of my scientific memoirs.* I am, however, sorry to have to admit that investigations which I have carried on after those memoirs were written, have compelled me to alter, or at least to modify, some of the views set forth in those volumes, and to-night I shall therefore to some extent have the somewhat ungrateful task of trying to pull down again some parts of my own building.

I think we shall do well by dividing the subject before us in two parts:—

1. First, we ought to find out what the problems of the Unknown North really are, and which of them are important.

2. Secondly, we have to examine which methods of exploration are best for a successful solution of these problems, and what kind of observations are especially desirable.

The Problems of the Unknown North.

Many of the most important problems of the North Polar regions have been more or less solved by the various expeditions of late years. The northward extension of Greenland and its islands has been settled by Peary, new northern lands of the American Arctic archipelago have been explored by Sverdrup, the northward and westward extension of the Franz Josef archipelago has been settled by the *Fram* Expedition, by Jackson, and by the Duke of the Abruzzi; the small extension of Bennett island was discovered by Baron Toll. There is, in fact, no known land in the north whose northern coasts are not now explored. And, moreover, perhaps the most important feature of North Polar geography, viz. the deep North Polar basin extending eastwards north of Spitsbergen, Franz Josef Land, and the New Siberian islands, has been discovered by the *Fram* Expedition, and the great features of its currents and oceanography have been explored. The eastern shallow part of this sea, north of eastern Siberia, was traversed by the *Jeannette*. During his recent expedition through the North-West Passage Amundsen has explored the magnetic north pole, and many important problems of that interesting region will probably be solved when his magnificent material of observations has been worked up. It may also be pointed out that the Greenland inland ice, which is a very important feature of Arctic geography, has been crossed, and its northern extension has been settled by Peary.

* See especially, *The Norwegian North Polar Expedition*, 1893–96. *Scientific Results*, vol. 3, No. 9, and vol. 4, No. 13.

I think, therefore, that we have reason to look back with satisfaction upon the progress which the geography of the North Polar regions has made during the end of last century and the beginning of this. Hardly in any previous period of the same short duration has the knowledge of the Arctic Regions made similar important advances. But certainly we cannot stop here; there are still many problems of great interest waiting for their solution in the north. I shall try to mention some of them which I think can be solved without very great difficulty.

In order to get an idea of the chief problems of the still Unknown North, we have naturally to follow the ordinary process of reasoning from the known to the unknown, and we have, first of all, to ask ourselves the question: What do the known geographical, geomorphological, and geological features of the surrounding known regions tell us about the still unknown area near the north pole?

The discovery by the *Fram* Expedition of a deep north polar basin, with depths exceeding 2000 fathoms, is very important in this respect. Sir Clements Markham even says, that "it drew the veil from the Arctic mystery and made all things clear." This deep North Polar basin forms the northern termination of a series of oceanic depressions, extending northwards through the Norwegian sea, from the eastern side of the Atlantic ocean, and dividing the continental masses of the old and the new world. These depressions, following to some extent the direction of the meridian, form evidently a more or less continuous tract where, during some remote geological period, the Earth's crust has sunk in owing to certain causes which are, however, difficult to explain, and we shall not discuss here the various theories attempted. The different basins of these depressions are separated by transverse submarine ridges, *e.g.* the Scotland-Færoe-Iceland-Greenland ridge, the Jan Mayen ridge, extending from Jan Mayen towards Bear island, and also a ridge extending north-west from Spitsbergen probably towards northern Greenland. We know that the depression of the North Polar basin extends from the latter ridge continuously towards the north-east and east as far as north of the New Siberian islands, but how much further eastwards is unknown, and so is also the width of the basin towards the north. Its measured depths vary between 1800 and 2100 fathoms.

The sinking in of the Earth's crust during the formation of such a deep and probably extensive basin is always accompanied by considerable volcanic disturbances along the edges of the sinking area. For instance, the Pacific ocean forms a great area of depression where, in several places, sinking of the sea-bottom is evidently going on at present, and it is not long ago that the citizens of San Francisco and Lima felt the disastrous effects of this process. By the eruptions of lava and basalts, connected with such changes in the Earth's crust,

permanent traces are left to posterity by which the geological age of the changes can be determined.

The edge of the North Polar basin is but little known. As far as our knowledge goes, there are no very modern volcanic formations in these regions. The whole of Franz Josef Land, and some part of eastern Spitsbergen and King Charles Land, are to a great extent formed by basalts from the later part of the Jurassic period, and perhaps early Cretaceous, but there are hardly any much later basalts. This might indicate that at least some sinking of the sea-bottom to the north has occurred during the later part of the Jurassic age and the early Cretaceous; but the first formation of the North Polar basin may have taken place long before that time.

On Bennett island the *Jeannette* Expedition found, according to De Long's diary, volcanic rocks and lava, which perhaps means basalt, but their geological age is unfortunately unknown. The sad disappearance of Baron Toll, who visited the island some years ago, has prevented us from ever knowing what this distinguished explorer and geologist had found out as to the geology of this island, which he discovered to have a very small extension.

The basalts known on the west coast of Greenland, in the region of Disco island and further north, and those on its north-eastern coast, in the region of the Scoresby fjord and north of it, are from a much later period, chiefly the Tertiary, and seem to belong to the period of eruptions represented by the basalts of Scotland and the Færoes, which again, by the basalts of Iceland and Jan Mayen, are connected with modern times. It is, of course, possible that volcanoes and volcanic formations of a similar period may exist in the Unknown North, or in the insufficiently explored parts of the Arctic Regions. But according to what we know at present, it might seem natural to conclude that the formation of the North Polar basin by sinking of the sea-bottom was finished near the end of the Jurassic and the beginning of the Cretaceous period; whilst the bottom of the Norwegian sea has, in its southern and eastern parts, been sinking in during the Tertiary period, and these disturbances are not yet quite finished in some parts (near Jan Mayen and Iceland).

If we knew the edges all round of such a deep basin, formed by sinking in of the Earth's crust, we could assume, with a high degree of certainty, that extensive land masses cannot possibly exist inside these edges, rising from the bottom of the deep basin. For we cannot possibly assume that, when the basin was formed by sinking of the crust, an isolated block of land, or what the geologist would call a "horst," should have been left in the middle, without any connection with the continental coasts or land masses surrounding the basin, and without taking part in the universal sinking of the crust on all sides of it. This does not, however, exclude the possibility that more or less isolated

volcanic islands, like Jan Mayen, may occur inside the edges of such a deep basin, rising up from the depths of the sea, and built up by volcanic action during or after the sinking of the sea-bottom.

What has just been said demonstrates the importance of knowing the actual edge of the deep basin on all sides of the North Polar sea. But this edge is very far from coinciding with the visible coasts of the continent, as is easily seen by a glance at the North Polar map at the end of the present number. If we do not know the depths of the sea outside the coast, and the chief morphological features of its bottom, the knowledge of the coasts alone tells us, in fact, very little in this respect. We thus see the great importance of exploring, not only the coasts and the surface of the sea, but we have to sound its depths, and trace the morphological features of its bottom. For instance, as long as we know hardly any soundings to the north of the American Arctic archipelago and Greenland, and only very few north of Alaska, it is almost hopeless to try to draw any conclusions from the known geographical and geomorphological features as to possible land masses to the north of this region. I shall come back to this a little later, but I wish to mention what we know about the

Continental Shelf of the North Polar Basin.

What is a *continental shelf?* By this expression we mean the submarine platform surrounding most continental coasts, and extending in some regions far seawards as a very level drowned plain, generally at a depth of between 40 and 80 fathoms below the present sea-surface. At its edge the sea-bottom, as a rule, suddenly breaks off and slopes comparatively steeply towards the deep basins of the ocean (see Fig. 1). This shelf is a most important geomorphological feature, which has not hitherto, in my opinion, had the attention of geographers to the extent which it deserves. When systematically studied, it will certainly give us much more information about the history of continents and the surface of the Earth than has hitherto been fully realized. Many geographers and geologists have paid attention to this interesting feature, but, as a rule, more or less accidentally. In a memoir on "The Bathymetrical Features of the North Polar Seas, with a Discussion on the Continental Shelves and Previous Oscillations of the Shore-Line," * I tried some years ago to take up this subject for a more universal investigation, but it is a complicated question in several respects, as the soundings and our knowledge of the sea-bottom are still very imperfect in most regions, even near the coasts.

How have the continental shelves been formed? They are partly

* *The Norwegian North Polar Expedition*, 1893–96. *Scientific Results*, vol. 4, No. 13. Christiania, 1904. See also my paper, "Oscillations of Shore-lines," the *Geographical Journal*, December, 1905.

built up by river and sea sediments, and are partly cut by a joint effect of atmospheric erosion and marine denudation caused by wave-action.

The greater part of the area of the continental shelves has once been dry land, and their edges indicate, therefore, more or less the real boundaries of the continents. They have, as a rule, comparatively lately been elevated above sea-level, as is proved by the drowned valleys still traversing them in many places. I ought, perhaps, already here to point out that there is a marked difference between a submarine or drowned river-valley and a submarine fjord, the latter having all

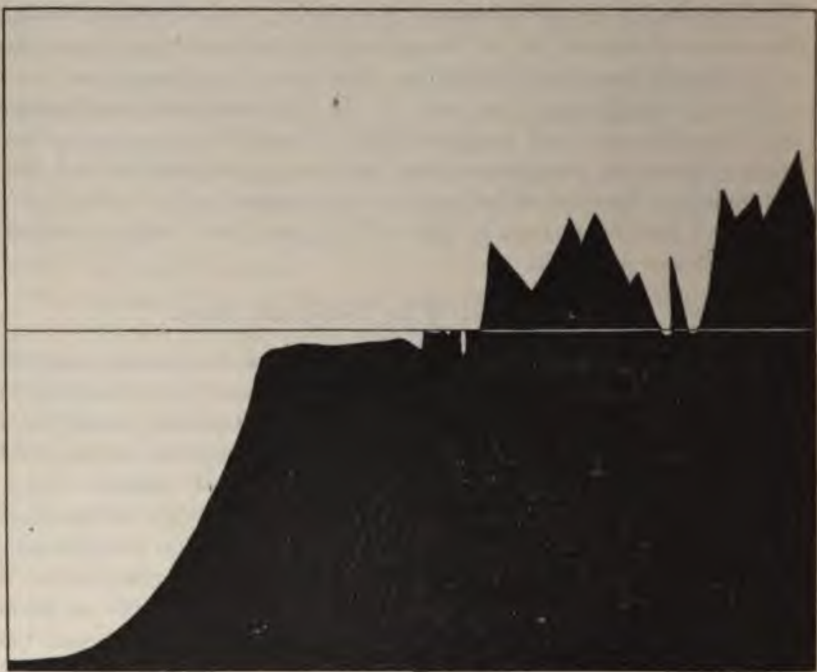


FIG. 1.—SECTION ACROSS CONTINENTAL SHELF IN REGION OF HARD PRIMARY ROCK, NORTH OF LOFOTEN ISLANDS. VERTICAL SCALE EXAGGERATED 25 TIMES.

the characteristics of a valley excavated, or at least shaped, by glacial erosion, as for instance in Norway. The occurrence of submarine fjords on a continental shelf does not with certainty prove that the latter has been elevated into dry land when the fjords were formed or were reopened for the last time, as they may have been reopened and deepened at present sea-level by submarine glacial erosion.

After this digression we ought to return to our North Polar sea, where we not only wish to know the distribution of land and water on the sea-surface, but where we wish almost still more to know the land and water under the ice-covered surface. It would be of the very

greatest interest to know the form and northward extension of the continental shelves from the known coasts into the still Unknown North; we should then be able to trace out the chief geographical features of this region, and get an idea of the actual shape and extension of the deep North Polar basin. A satisfactory exploration of the North Polar continental shelf would therefore be a great achievement worth trying, compared with which the question whether islands project above water-surface from the shelf or not is of minor importance.

The actual edge of the North Polar continental shelf has only been found in two different places, viz. north-west of the New Siberian islands, and north of Spitsbergen. In the entire rest of the North Polar sea the situation of the continental shelf is still unknown.

The Continental Shelf North of Siberia.

The *Fram* soundings proved the edge of the continental shelf north-north-west of the New Siberian islands to be about 400 statute miles from the Siberian coast, and the shelf is unusually shallow and flat, less than 50 fathoms below sea-surface. Beyond its edge the sea-bottom forms a very sudden and steep slope towards the deep basin (see Fig. 2).

Eastward from this region the continental shelf extends towards Bering straits, as an unusually wide and flat submarine plain at depths of usually less than 50 fathoms below sea-surface. The New Siberian islands, Bennett island, Henrietta and Jeannette islands, Wrangell island, and Herald island are lying on this flat shelf. As proved by Baron Toll, Bennett island is very small, only some few miles in diameter. This might, I believe, have been expected from the observations of the ice-drift during the *Fram* Expedition; but how far north the continental shelf extends in this region is unknown. The numerous soundings taken during the drift of the *Jeannette* prove that the continental shelf between Bennett island and Bering straits is at least 300 miles broad, but how much broader is unknown. It is possible that the *Jeannette* was actually near the edge of the shelf during some part of the drift, as during northerly turns in the drift near the longitude of 170° E. the depths suddenly increased from the general depth of between 30 and 40 fathoms to about 70 and 80 fathoms. This might have been the beginning of the continental slope towards the deep basin; but it is also possible that it was only a submarine valley or channel, beyond which the continental shelf extended further northwards. North of Bering straits numerous soundings have been taken, showing that the continental shelf there extends at least to a similar distance of about 300 miles from the Siberian coast, and its depth is very much the same, about 30 to 40 fathoms. Some of the northernmost soundings, north-east of Wrangell island, give, however, greater depths, increasing towards 80 fathoms. It is uncertain whether this increase of

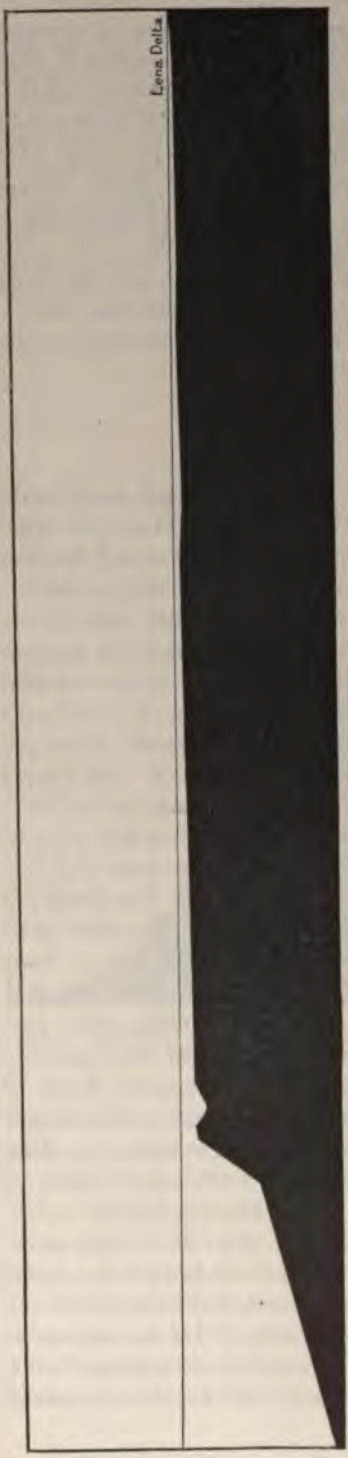


FIG. 2.—SECTION ACROSS THE SIBERIAN CONTINENTAL SHELF NORTH OF LENA DELTA.

depth indicates the actual edge of the shelf, as might seem probable, or simply submarine valleys.

The edge of the shelf to the north of western Siberia, between the *Fram's* northward route near the New Siberian islands and Franz Josef Land, is unknown, but in this region we know, however, from the *Fram's* drift, that there is a deep basin to the north. It seems probable that the edge comes nearer to the Chelyuskin peninsula than to any other part of the Siberian coast. Here we have one sounding of 68 fathoms of the *Vega*, quite near the northern promontory, whilst the general floor of the Siberian continental shelf lies, as before mentioned, at a level of about 30 and 40 fathoms or even less.

About midway between Cape Chelyuskin and the northern end of Novaya Zemlya a small island, Ensomheden (or Lonely island), rises above the sea-surface from the shelf. It was found accidentally by a Norwegian walrus hunter, Captain E. Johannesen, and there may be more islands in this region, but the edge of the shelf is not known.

The shelf north of the Franz Josef archipelago is unknown. Julius Payer thought that in Franz Josef Land he and Weyprecht had discovered the southern coasts of an extensive ice-covered continent producing icebergs like those of Greenland. Even men like Admiral Melville, who had experienced the drift of the *Jeannette*, have held the view that the north pole could be reached by a sledge-expedition over the surface of this continent; a task which Captain J. F. Jackson set out to do.

By the sledge-journey of Captain Johansen and myself, this continent was sunk into the sea. By Jackson's explorations and ours, as well as those of Leigh Smith and others, Franz Josef Land was broken up into an archipelago of many comparatively small islands. And by the expedition of the Duke of the Abruzzi, even Petermann Land and King Oscar Land, which Payer thought to have seen to the north, was for ever obliterated. The Franz Josef archipelago rises from the continental shelf, but how near its margin cannot be decided. Although Johansen and I must have crossed its edge coming from the north, we cannot tell where the edge was, which shows how very limited the knowledge obtained by an ordinary sledge-expedition actually is. As the Franz Josef archipelago is built up of basalts and Jurassic clays, which give way rapidly to erosion, it seems probable that the marine denudation during ages has been able to form a comparatively broad continental shelf to the north of its coasts.

On the east side of the Franz Josef archipelago there may possibly be still unknown islands. During our sledge journey north-east of that archipelago we discovered, in July, 1895, that the southward drift of the ice, which northerly winds produced, was stopped by land to the south of us, and this might indicate at least some islands east of those now known. Mr. Baldwin, of the Wellman Expedition in 1899, actually discovered an island in this region, but I have never seen a detailed description of the work of that expedition.

Between Franz Josef Land and the Siberian coast the deep North Polar basin forms probably a deep embayment extending southwards. This is proved by some soundings, deep-sea temperatures, and water-samples which Admiral Makaroff took in the sea north of Novaya Zemlya in 1901.*

The continental shelf north of Alaska may be comparatively narrow, as a few soundings of 140 fathoms with no bottom have been taken 50 miles from the coast. These soundings may indicate the edge of the shelf; but there is, of course, also the possibility that they have been taken in submarine fjords. An exploration of the extension and nature of the continental shelf off this coast would be of great value, and interesting results in that respect could certainly be attained without great difficulties by properly equipped sledge-expeditions starting from the Alaskan coast.

We know practically nothing at present with regard to the extension and nature of the polar continental shelf north of the American Arctic archipelago, and we cannot say much as to what might be expected in that direction. Sir Albert Markham's sounding of 72 fathoms at his

* See Nansen, "Northern Waters," *Videnskabs-Selskabets Skrifter* (Christiania, 1906), 1, No. 3, pp. 49–54. See also *Norwegian North Polar Expedition*, 1893–96 *Scientific Results*, vol. 4, No. 13, p. 16.

farthest north is the only sounding known, taken at some distance from land on that shelf. We cannot know whether this one interesting sounding was near the edge of the shelf or not, whether it indicates the level of the general floor of the shelf or whether it was taken in one of the submarine fjords, which are probably numerous in that region.

In my memoir, mentioned before, I pointed out that the continental shelves have a tendency to be narrow outside high and mountainous coasts, especially where these are built up of hard primary rocks, whilst they are broader outside low coasts; I therefore maintained that we cannot expect the continental shelf to be very broad north of Greenland, Ellesmere Land or Grinnell Land, and Axel Heiberg Land, or at least not so broad as north of Siberia. Dr. J. W. Spencer * has afterwards accentuated this view. It should, however, be considered that the above rule is especially valid in regions where the direction of the mountains along the coast also indicates the direction of the coast-line, and is intimately connected with the formation of the continental slope off the coast, as is, for instance, the case in Norway. Where this is not so, the conditions are often different; *e.g.* the fairly high coasts of Finmarken, which are not formed by primary rocks, have a very extensive shelf to the north. Novaya Zemlya is a mountainous land, but with rocks from different periods, and it is situated in an extensive shallow sea, on an enormous continental shelf. Spitsbergen is built up of different rocks; it has a narrow shelf to the west and north, but very broad to the south and east.

The islands of the American Arctic archipelago are also built up of rocks from various geological periods, and we still know too little to say much about their tectonic structure. There are, however, hardly any mountain formations or mountain chains corresponding to the trend of the known northern coasts. Nor can we say that they are specially high and mountainous. On Sverdrup's new lands there seemed, for instance, to be a low foreland towards the north. What we know in this respect does not, therefore, exclude the possibility of an extensive continental shelf to the north, *e.g.* off Sverdrup's new lands, or north and west of Prince Patrick island and Banks island.

Dr. Spencer assumes that the American Arctic archipelago is a dissected plateau region originally fashioned by atmospheric agents, and subsequently submerged, more or less. He consequently considers the present sounds between the islands to be drowned river valleys, and as the known soundings show that some of these are very deep, he comes to the conclusion that their length before they reach the deep sea, *i.e.* the edge of the continental shelf, cannot extend very far beyond the known coast to the north and west. I am, however, afraid that this

* J. W. Spencer, "On the Physiographic Improbability of Land at the North Pole," *American Journal of Science*, vol. **19**, May, 1905.

argument does not carry great weight in this particular region. Great depths of submarine fjords at certain places do not tell much about the length and depth of the fjord outside the deep hollows, wherever the lands have been exposed to glacial erosion. As examples might be mentioned the Norwegian submarine channel off the southern coast of Norway, or even the Baltic, where deep hollows have been excavated at great distances from the deep sea.

And besides, it has to be considered that the American Arctic archipelago exhibits in several respects features which are quite unique and exceptional on the Earth's surface. If, for instance, we assume that the sounds between these many islands are actually submerged fjords—*i.e.* original river-valleys which have afterwards been excavated and given their present shape by glaciers—we will not here consider whether they may originally be due to special tectonic structures—then these fjords are without comparison the greatest fjords of the world. Take, for instance, a fjord like the one extending through McClure strait, M'Clintock channel, and Queen Maud sea; it has such enormous dimensions that the greatest fjords of Norway or even those of north-eastern Greenland would be mere dwarfs in comparison. It might more appropriately be compared with the Baltic, or the great submarine valleys of the Barents sea. We know, however, very little about the depths of these sounds and fjords, and a systematic survey of them in connection with an exploration of the geological structure of their coasts would be most interesting. We might then hope to obtain a knowledge of the history and formation of these most remarkable features, which would be of very great value.

What we know is, however, sufficient to warn us that in these regions there are exceptional conditions, and it is very difficult to apply here conclusions drawn from geomorphological features observed in other parts of the world. These regions were probably near the home of the great North American Ice Age, in a similar way as the regions of the Baltic and the White sea were near the home of the great European Ice Age; the land has been even more dissected into islands and peninsulas than has been the case in the latter regions, whatever the first cause of this dissection might have been.

To summarize the results of the above discussion, it might be said that the known geographical and geomorphological features of the Arctic regions do not exclude the possibility of a wide extension of the continental shelf beyond the northernmost known islands of the American Arctic archipelago and Greenland, and there may be unknown lands on this shelf in the Unknown North. It is also possible that the Siberian continental shelf may have northward extensions with land in the region between the New Siberian islands and Alaska.

To mention a parallel, I may point out that if we had only known the northern coasts of Norway, Russia, Novaya Zemlya, and Siberia, and

the sea outside those coasts, and if Franz Josef Land, Spitsbergen, and Bear island, etc., had not been discovered, it would have been very difficult indeed to infer their existence from the geomorphological features we had then known; and what is more important, the existence of the enormous continental shelf to the north of these coasts would still remain unknown.

It would be an achievement of the very greatest importance, from a geomorphological point of view, to determine the edge of the continental shelf in as many places as possible round the North Polar basin.

The North Polar Currents and the Drift of the Ice.

Let us now examine what the known oceanographical conditions of the North Polar sea might possibly tell us about the Unknown North, and let us first direct our attention towards the *currents* in this sea-basin.

As may possibly be known, it was a careful study of the sea-currents and the drift of the ice, etc., which led me to the conclusion that there was a great sea to the north of Spitsbergen and Franz Josef Land, and that this sea was crossed by a drift-current which might be used to carry a ship across the then unknown north from the region of the New Siberian islands towards the opening between Spitsbergen and Greenland. It is, perhaps, also known to you that the *Fram* Expedition actually proved this hypothesis to be true. In a similar manner, a study of what is now known about the currents and the ice-drifts of the North Polar sea might give us some reliable indications as to the conditions in at least some part of the now Unknown North. I shall not go into details on this somewhat special subject, but try only to mention the more prominent features.

If the *Fram* had not worked her way, under Captain Sverdrup's excellent leadership, out of the ice north of Spitsbergen, in 1896, she would have been carried south-westwards with the ice-drift, or, as it is usually called, the East Greenland polar current, along the East Greenland coast towards Iceland. We can, however, say with much certainty that she would not in this way have come near to the Greenland coast, but would have been separated from it by a broad belt of polar ice, which must come from an extensive area to the north of the *Fram's* route. The mean velocity with which the ice is carried southwards by the Greenland polar current is sensibly greater—three or four times greater—than that with which the *Fram* was drifted along, even during the latter part of her drift, when the velocity was greatest. Unless we assume that the velocity of the ice-drift is very much greater to the north of the *Fram's* track, we are consequently obliged to conclude that the ice-drift converges from a considerable area in the Unknown North, in order to produce the polar ice-masses of the Greenland polar current. I consequently came

to the conclusion that there cannot be much land to the north and north-west of the *Fram's* track in the region north of Greenland. The correctness of this conclusion seems to have been borne out by the experiences during Peary's latest expedition. He was greatly hindered in his journey by the strong eastward drift of the ice in the region north of Greenland; and he met with long water-lanes and channels going in an easterly direction. These long open-water channels might be compared to some similar ones Johansen and I met with on our sledge-journey southwards towards Franz Josef Land; they extended in a westerly or south-westerly direction, probably more or less in the direction of the ice-drift in that region. It seems as if the ice-drift in the sea to the north of Spitsbergen, Greenland, and Ellesmere Land (Grinnell Land) converge towards the opening between Spitsbergen and Greenland, as was expected beforehand. But Peary's experiences do not entirely exclude the possibility that there might have been some land somewhere to the north of his farthest. Little can be said about this as long as the depth of the sea over which he travelled is unknown. As, however, the ice seems to have come drifting freely from the west, it is improbable that there has been much land anywhere near his route in that direction.

Mr. R. A. Harris, of the United States Coast and Geodetic Survey, has, in a paper on "Evidences of Land near the North Pole," * set forth the hypothesis that the surface currents in the shallow sea to the north of Bering straits, Alaska, and Eastern Siberia, prove the existence of an extensive land to the north in that region (see Fig. 3). He maintains that currents in this region run eastward in the sea north of Alaska, and north-westwards north of Siberia. He speaks of these currents as if they ran like rivers in the sea from certain points, *e.g.* from Herald island to certain points, *e.g.* to Cape Farewell. He has hardly realized that the surface currents of the North Polar sea are drift-currents extending over great areas, and that the winds influence them, and to some great extent create them. He gives us no explanation of how or where his two currents originate, but if they really existed, as he imagines, they would, if anything, rather prove that there can be no extensive land to the north, enclosing the sea of this region into a broad channel, as on his map. He has evidently not realized that if the water were running both north-westwards and eastwards out of his shallow enclosed sea-channel, the latter would very soon run dry in the middle. For wherefrom should then the supply of water for these two currents come? As Sir Clements Markham has already pointed out, it cannot come from the south through the narrow and shallow Bering straits, and the sea to the north he has himself landlocked. We know as yet very little about the currents in this region. The ice-drift is there very slow and irregular,

* 'The Eighth International Geographic Congress, Washington,' pp. 397–406.

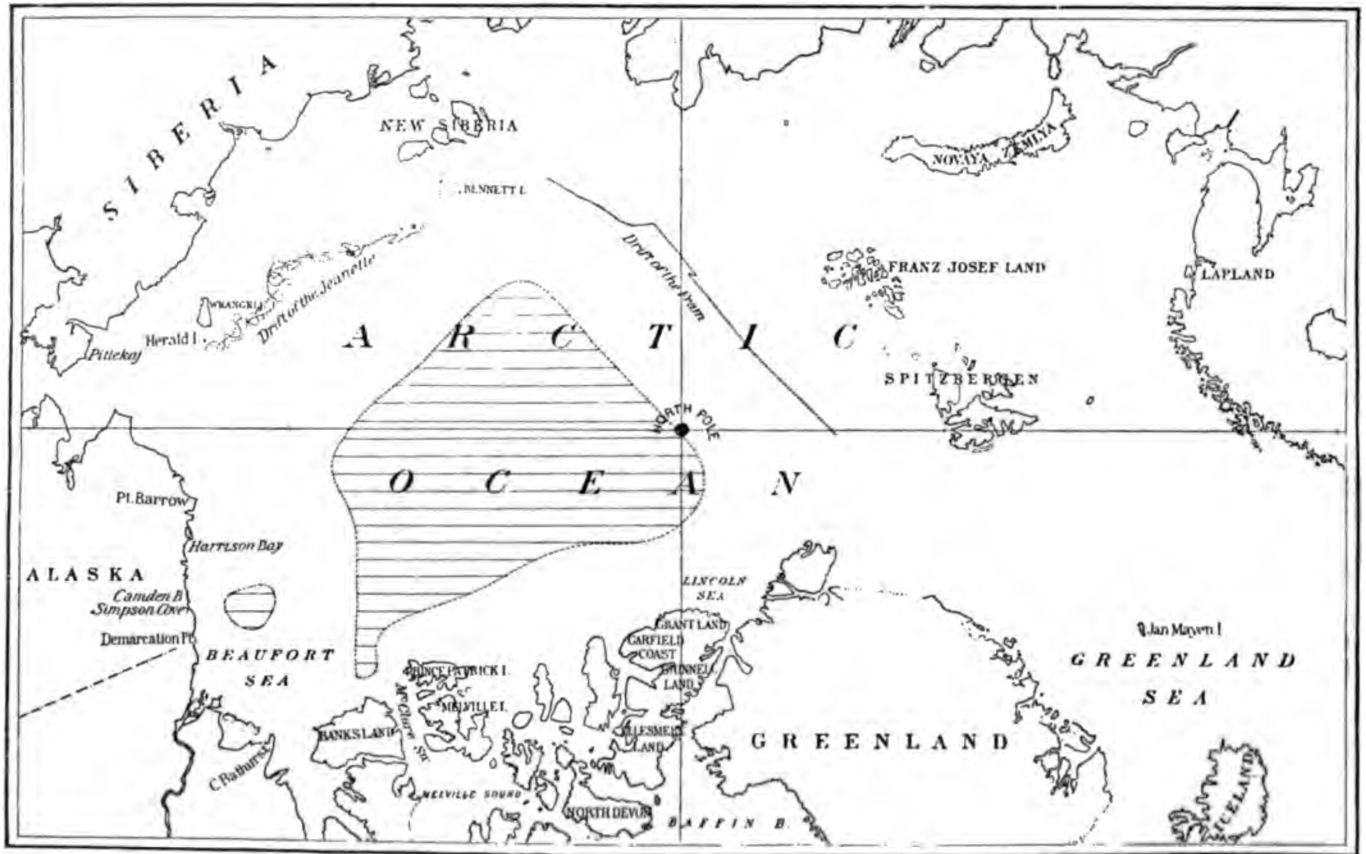


FIG. 8.—FACSIMILE OF HARRIS'S MAP OF ARCTIC REGIONS, SHOWING OUTLINE OF INDICATED NORTH POLAR LAND.
(From *National Geographic Magazine*, vol. xv., p. 256.)

and seems to be almost entirely dependent on the winds. We cannot, therefore, expect to get much information from that source as to the possibility of land to the north.

Sir Clements Markham mentions a point to which Mr. Einar Mikkelsen had drawn his attention, and which he thinks to be of considerable importance. It is the steady increase of the mean velocity of the drift of the *Jeannette* during her route westwards. He thinks that this acceleration of the drift must be due to the effect of the Siberian rivers; but as the *Jeannette* was not carried more northwards by this effect, he considers it probable that there was some land to the north to stop the drift in that direction. But Markham has evidently not been fully aware that the drift of the *Jeannette* was to a very great extent caused by the winds. It would be necessary to know exactly the strength and directions of the winds, and to compare them with the corresponding distances and directions drifted by the *Jeannette*, in order to draw any conclusions as to the relation between her drift and the possibility or probability of land to the north; and even then it would be an extremely difficult task. If we assume that the drift of the *Jeannette* was chiefly caused by the winds, it might, perhaps, with equal right be said that the westward increase of the mean velocity of her drift indicates no land to the north in that region, for if there had been land, this would stop the movements of the ice, and consequently reduce the effect of the wind on the ice.

By a careful analysis of the wind-observations as compared with the drift during the *Fram* Expedition, I have tried to find out the direction of the permanent currents of the surface water independent of the changing winds; and the results I obtained agree remarkably well with each other, giving a surface current running in the direction of Franz Josef Land and Spitsbergen (see Fig. 4).*

This result is, however, difficult to explain. For if we assume that the current is formed by the light outflowing surface water of the polar sea, diluted by the river-water from Siberia and America, this outflowing water would, owing to the Earth's rotation, be deflected towards the right, and would consequently run out along the right-hand side of the basin, *i.e.* along the Greenland side. If, therefore, the current actually runs in the direction I have found, it might seem to indicate that there was land to the north of the *Fram's* route, preventing it from running in that direction. But even then it seems very puzzling that the current does not at least follow the direction of the coast of that unknown land, instead of running so far towards the left. It is, therefore, hardly probable that the actual current is running in the direction I have found; the movement of the ice to the north of our track may,

* See *The Norwegian North Polar Expedition*, 1893–96. *Scientific Results*, vol. 3, No. 9, 1902, plate 1, and pp. 357 *et seq.*

FIG. 4.—THE ARROWS INDICATE DIRECTION AND RELATIVE VELOCITY OF PERMANENT CURRENT OF SURFACE WATER, AS FOUND BY THE *FRAM* OBSERVATIONS, 1893–96.

for instance, have influenced the movements of the ice near the ship, and thus I may have come to somewhat misleading results as to the surface currents.

The Nature of the Ice in the Different Parts of the North Polar Sea.

The North Polar sea is covered by an almost continuous sheet of ice, which, however, is nowhere at rest, except for short periods near the coasts and between islands in the winter. On the whole, it is everywhere carried along across the sea by winds and currents; at some places slower, at others faster. The chief direction of the drift is from the Siberian-Alaskan side towards the opening between Spitsbergen and Greenland, as was proved by the drift of the *Fram*, in connection with that of the *Jeannette*, and also by other evidences, especially the driftwood. A smaller amount of ice is carried out through the channels of the American Arctic archipelago into Baffin bay, and southwards towards Labrador and Newfoundland. Some ice is also carried out south of Franz Josef Land.

By studying carefully the nature of the ice, its thickness, age, appearance, etc., along the north polar coasts, one might possibly attain some information as to the sea to the north, from which the ice has come or towards which it may be drifting. This has been done by various authors, but not always with success. It is naturally essential to know which features of the ice it is of special importance to pay attention to. If, for instance, in a region like the Siberian sea, with a low mean temperature of the year, we find comparatively young ice, with no great thicknesses of the flat floes, it proves that the general ice-drift in that region is directed seawards from the coasts, and no ice is allowed to remain there to grow very old. The height and dimensions of the hummocks and ice-ridges are of little importance in this respect; they may, however, prove that there have been heavy ice-pressures, which may be caused by winds, or still more by tidal currents. These hummocks prove, furthermore, that the sea is not enclosed, and not protected by land in a near vicinity, for then there could hardly be any heavy ice-pressures to produce them.

If, on the other hand, we find in a sea like that off the northern coasts of Greenland and Ellesmere Land, very heavy and old ice, where the flat floes have a very great thickness, and where there are enormous hummocks which are very old, and to a great extent shoved landwards into shallower water, this may tell us that the ice has drifted for many years in the sea, and that the general direction of the ice-drift to the north is directed more or less towards the coasts, and is very slow, being blocked by the land. It would, however, be a mistake, as some authors have done, to infer from these circumstances, that the ice in this region is held by land to the north, which prevents it from being

carried away. The unusually great hummocks point rather in the opposite direction; they must have been formed by very heavy ice-pressures, which cannot occur in an enclosed sea, but require an extensive sea-area where extensive ice-masses are in motion.

In order to compare the ice of one region with that of another, it is essential to get actual measurements of the ice, especially of the flat floes that are not piled up by ice-pressures, and to have trustworthy statements as to the age of the ice, as may be found out by its salinity, its snow-layers, its accumulations of dust and diatoms on the surface, etc. It would also be of interest to know, by exact measurements, the actual height of the hummocks, etc. To go by the ordinary popular descriptions often met with in accounts of Arctic voyages may be very misleading. The ice which may make an imposing impression upon one observer, might make a very different impression upon another. If, for instance, Payer's somewhat fantastic description of the ice in which the *Tegethoff* drifted north of Novaya Zemlya, be compared with descriptions of the ice off the northern coasts of the American Arctic archipelago, one might come to the conclusion that the former ice was much the heavier. Payer even speaks of hummocks with heights of 40 and 50 feet as quite common. Now we know, however, that the ice in this region is comparatively young and thin, and the hummocks hardly ever exceed 20 feet in height by sober measurements.

We have now actually descriptions by various travellers of the ice along the whole of the western and northern coasts of the American Arctic archipelago, from Alaska to the north coast of Greenland—Collinson and others north of Alaska, McClure and Sherard Osborn along the west coast of Banks Land, M'Clintock and Mecham along the west coast of Prince Patrick island, Sverdrup along the coast of his new lands (E. and A. Rignes islands, and Axel Heiberg island), Aldrich, A. Markham, Nares, Beaumont, Lockwood and Greely, and Peary along the northern coasts of Ellesmere Land and Greenland. It might, therefore, seem possible to come to some conclusion as to the region to the north and west by a careful comparison of these descriptions; but unfortunately they are all more or less popular descriptions, with very few measurements. And besides, it has to be considered that the nature of the coast itself may have a great influence upon the appearance of the ice; *e.g.* a flat coast with shallow sea outside may be bordered by ice with grounded hummocks, which have an appearance different from that of ice outside a steep coast with deep water, although it may actually be the same ice. In fact, the appearance of the ice may differ very much along the same coast, even at very short distances. It is, therefore, hardly possible to come to any certain conclusions as to the Unknown North from the known descriptions of the coast ice.

Mr. R. A. Harris makes, in the above-mentioned paper, the mistake of drawing rather far-reaching conclusions from such popular and

indistinct descriptions of ice. He attaches great importance to the very heavy old ice, which is said to have been met with in the Beaufort sea; but the quotation he gives from Osborn's description, in order to prove it, is not fortunate. Such descriptions as, for instance, "ice of stupendous thickness and in extensive floes, some 7 or 8 miles in extent, not flat but rugged with the accumulated snow, frost, and thaws of centuries," can hardly be said to carry any very accurate idea of what kind of ice has actually been seen. Whether we are expected to take such expressions as "accumulated snow of centuries" simply as an ornament of *licensia poetica*, or as a description of the author's real view, I do not know. I have in another place * pointed out that the drift-ice in the north polar basin, where the *Fram* drifted, does not, as a rule, attain a higher age than five years; how much older it may become on the American side we do not yet know.†

But even if it be so that the ice of the Beaufort sea is very heavy and old, it proves nothing as to the probable existence of land to the north. It only shows that the drift of the ice is very slow in this region, as it may be blocked by the land already known. That the ice is rugged proves that it has been exposed to ice-pressures, and this is no evidence in favour of unknown land seawards, or to the north; it proves nothing in this respect, only that the sea is not, at any rate, land-locked.

Sir Clements Markham has mentioned, in his above-mentioned paper, that Sir Richard Collinson attempted to cross the ice northward from Alaska, but, finding very heavy ice, he was compelled to return after a day or two. This proves only that the ice in this region had been much broken up by ice-pressures, but gives no indication as to possible land to the north. If anything, the evidence would go in the opposite direction.

The fact that the ice in this region is never seen to recede far northward from the northern coast of Alaska, nor westwards from Banks Land, points no more to land to the north, as Mr. Harris suggests, than, for instance, the circumstance that the ice never seems to recede much northward from the northern coasts of Taimur peninsula and Cape Chelyuskin, and Ellesmere Land, and Greenland. The distribution of the ice is dependent on its drift, which is greatly influenced by the prevailing winds.

(To be continued.)

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* See *Norwegian North Polar Expedition*, 1893–96. *Scientific Results*, vol. **3**, No. 9.

† If it were actually possible that the ice in some enclosed land-locked sea could become centuries old, and be covered by accumulated snow of centuries, it must naturally be perfectly flat, as there cannot be any movement or pressures in the ice. Osborn's or McClure's description of the ice of Banks Land as being very old, with a surface of rounded hill and dale, seems to prove that this ice had not been exposed to ice-pressures lately. Farthest north, in the centre of the North Polar basin, I found, however, ice of which a similar description could well be given.

THE FAN MOUNTAINS IN THE DUAB OF TURKESTAN.*

By W. RICKMER RICKMERS.

Just off the north-eastern face of Khon Tagh we climb an old moraine, which divides the valley floor into an upper and a lower level. Proceeding further, we branch off from the Pasrud for a while, and climb the Laudan valley by a good path, which leads through fine groves of ancient thuyas, gnarled, twisted, and weather-beaten. Emerging upon pleasant downs, where hidden glens are full of sweet herbs for the horses, we make our camp at a height of 9000 feet, which is more or less the upper limit of the thuya tree, the good friend who supplies us with fuel. Grass ascends to about 12,000 feet, and in valleys of the Pamir type even higher, as we saw at Tupchek. A stiff breeze, blowing from the head of the valley, teases the flapping canvas of the tent; the noise of camp life is answered by the shrill whistle of the marmot as it dives into its burrow. These little red-coats are very plentiful, and so is the eagle, which spies them from above.

Next day we are impatient to reach the top of the pass, in order to enjoy what we have been longing for: a mountain view in bracing air, after those tiring marches through the ovens of hell-baked stone. At first the rise is gentle along the middle of the trough. The sun is up, and the traffic is astir, coming and going—horsemen proud of purse and bronze-faced wayfarers with heavy packs. Stout staves in hand, they have risen from behind their wind-shields, low walls blackened with the smoke of many fires. Bethinking ourselves of the flesh-pots, we await the progress of long streamers of dust, the pennants with which a cattle-dealer heralds his approach. We pay him his presumptive price, and pick a strapping yearling from the herd, which is to be sold at Samarkand. Yesterday we saw this flock sleeping in the sun at noon, closely huddled together and motionless, like a monster bale of wool. To-day they have begun to move at early morn; three hundred well-nourished sheep, black, brown, yellow, and white, fine strong animals, with the short curly fleece that seems to speak of wild forefathers, as does the wiry leg. But domestic is the blubbery bump of fat which wobbles on their buttocks as they walk. In front marches a small guard of clever goats, long-haired and dignified, as if aware of their responsibility as leaders. Behind are black calves, slow and clumsy. Then the drivers, urging forward with stick and stone, and blowing through their teeth the sound of the spitting cat; on their heels the faithful dogs, slinking drowsily, *blasé*. And last of all, arrayed in blue khalat and white chalma, the owner, enthroned upon a pair of carpet saddle-bags that almost hide the shaggy pony.

We push on. The pasture-mat, now almost brittle straw, is notched

* Continued from p. 371. Map, p. 468.

into long strips by the feet of grazing animals. This makes the slopes look like a hatched map. But the thin silvery lines of the watercourses are bordered with a fringe of lawn, sprinkled by the splashing stream, and cropped close by every beast. The gardener of a tennis-ground would turn green with envy.

Soon we meet the first patches of snow, remains of avalanches covered with a film of slimy earth. And here the thuya begins to leave us, only sending up those twisted dwarfs, who can squat under weighty

GREAT LAKE.

snow, or crouch in hollows from an icy blast. Some drought-hard plants now wear their nuptial garb; the tough broom, the tangled clusters of yellow roses, and the royal thistle in its gorgeous ruffle of glossy grey leaves drawn out into long spines. Near the water nasturtium and a tiny dandelion are in flower. Presently our attention is claimed by the steepness of the path, which climbs a long and dreary slope by endless zigzags, and we restrain our curiosity until the top of the pass is reached (about 12,000 feet). Then we lift our eyes to look

around, and our silence and our talk speak alike of wonder and awe and of the eagerness of inquiry. First comes the overpowering nearness of those gigantic piles Khon Tagh and Chapdara. In the latter, which is drawn out into a long frontage of tremendous cliffs, we easily recognize the mountain visible from the plains of Pendjekent. The other is a colossal pyramid, with flanks carved out to make tiers of vertical precipices which surround the corries at their base. Where have I seen such walls before? Ushba, the Terrible, in the fastnesses of the Caucasus, comes back to memory. On its western side there is a sheer drop of 3000 feet. The shape of Khon Tagh is not nearly so bold, but its granite quarry shows an unbroken face of well-nigh double that height. Did I say granite? The square cut and the reddish colour of the blocks lead us at first to think that the two mountains which we have compared are built of the same stone. But later we learn that the material of the great Fan peaks is lime covered with a thin scale of shining rust.

Turning towards the background of the east, sight travels into the long vista of the Yagnob, between rows of many summits that lead further and further until the haze of distance blurs the outlines, and the needle-crags of Khakhifta are but weird pillars, like spectres vanishing in the mist. On the left is Vashan Tagh, a long embankment of slanting masonry which sends round the curve of its main spur to our standpoint. In the west are dry ridges hurrying away to the flat expanse of Turkestan, and immediately below us is a group of morainic lakes, little bits of round glass among a profusion of black dots, or, in other words, sheets of clear water on a plateau spotted with trees.

Studying the Russian 10-verst map (1 : 420,000), we find a good record of everything that has some practical interest; cultivated valleys, villages and hamlets, roads, bridges, and passes. It is, in fact, a splendid and valuable piece of work, covering, as it does, thousands of square miles of mountainous country. A very large staff of topographical officers have been busy for many years, with the result that we have before us a complete survey of the main features between Fort Pamir and Bokhara city. The realm of ice and snow they have filled up with a few located peaks surrounded by caterpillars of uncertain contortions and dotted lines. That is not a fault, for such detail had to stand back in view of more pressing needs, and has been left to the mountaineer. My own map does not claim to be a marvel of accuracy; it only gives the most important of the higher ridges, and its chief interest lies in the high valley of the Pasrud sources, never before visited by Europeans.

As to the names, I have adhered as much as possible to those of the Russian sheet. Native information seemed to favour Chapdara instead of Khon Tagh, and Chimtarga instead of Chapdara. But then, the Russian map mentions a big mountain called Chimtarga much further south, and owing to loss of time I have not been able to make sure of

its existence, whereabouts, and name. The name of Chapdara is therefore given to the peak whose position coincides with that of the ordnance, and Khon Tagh is the great mass which seems to have escaped the notice of the Russians. I hope to investigate the matter next year. It is always better to keep to the names on the first good maps, unless they be flagrantly unreasonable or misspelt. One must not listen too much to the inhabitants of different valleys, for in each the same mountain has another name, generally that of the pastures below it. The

PASRUD VALLEY JUST BELOW NATURAL BRIDGE.

shepherds, hunters, and guides of illiterate countries learn from the tourist the habit of choosing one and the same name for a mountain, no matter from which side it is seen. Topographic nomenclature is therefore more important to us, the tourists, travellers, and writers. On a topographic map (which is seen from above, from *one* direction only) a point is an absolute entity; the horizontal etymological relativity of a point can only be thrashed out in a book. The literature of civilized nations is so complicated that traditional names are havens of rest from

which we survey the ocean of undefined spaces; they are the fixed points which enable us to trace general outlines. A striking case in point is that of the map of the Central Caucasus, where Dykhtau has been changed into Koshtantau, and Koshtantau into Dykhtau, so that even I can only remember which is which when I have books at hand and can spend at least half an hour over the puzzle. This was done with the estimable but ludicrously belated ambition to satisfy the science of folk-lore. But a mere statement in a book of native usage would have sufficed,* whereas it was quite out of date to change ideas—not at all erroneous in themselves (a name is a name), nor leading to any misunderstandings—which had obtained the sanction of a famous history. This change affects a generation of mountaineers and the thousands of readers who identify the two peaks (or is it only one of them?) with the tragedy of Donkin and the conquest of Mummery. Therefore, firstly, let us find out the surest names from the beginning or give a number; and, secondly, let not the new-comer be too eager to "correct" well-established landmarks of recognized pioneers. If the pioneers know their duty to what is beautiful in geography—science need not be pedantry—they will avoid the bad taste of enlarging the dreary topographic edition of "Who's Who," or remind themselves of that Gargantuan *testimonium paupertatis* of human imagination, a list of American towns. Even in uninhabited regions the language of the nearest tribes (Eskimo, Waganda, Maori) might be used to coin short and pithy fancy names that do not clash with local colour.

With our view from the Laudan pass we may combine a short sketch of the geology of the district. I quote from the report of my dear friend Albrecht von Krafft, whose death in the service of the Geological Survey of India is still lamented by all who knew him. He passed through here on a rapid journey from Karatagh to Kshtut, and was only able to gather some of the more prominent facts. To his vivid description of the mighty peaks I owed my resolve to visit the Fan region as soon as possible. He says, "The northern slope of the Hazrat Sultan Alps (*i.e.* that branch of the Hissar range with which we are concerned) is far richer in sedimentary formations than the southern side. Near Saratagh begins the red and grey dolomite, the black limestone and calcareous limestone, which have a thickness of over 3000 feet. These masses of dolomite and lime reach to the northern foot of the chain, and all the great summits are formed out of them. Between the stocks of dolomite, the substratum, composed of phyllites, is occasionally laid bare. Dislocations traverse the district, so that the lower horizon of the limestones

* Perhaps some day the author of a map for tourists will print on the margin the most important facts in the history of the map—previous maps, etymology, doubtful points, references to books, etc.

is found at different heights. Margusar is in the midst of a dolomitic landscape, whereas the Laudan pass cuts into phyllites." *

Next day, on July 29, we made an attempt on Vashan Tagh, but were repulsed by an accident which befel me 200 feet below the top. I was struck by a stone, and had to be bandaged. To mention it at once, we also tried Khon Tagh a few days later, but had to retire.

Near our camp my wife and I had a somewhat dangerous encounter with two shepherds and three dogs, whom I was able to keep from mischief by a little diplomacy. Attacks on Europeans are exceedingly rare in Russian Turkestan, which may be said to be one of the safest countries in the world for the traveller. We had just been to a point of vantage above our Laudan camp, and from there had seen the deep valley of the Pasrud sources. Its wild loneliness gave hopes of interesting discoveries, and accordingly our tent was transposed to the Lailak Chapdara, as its occupiers called it. The flat space on which these summer huts are found (invisible on the photo because hidden away on the extreme right) is on the upper Pasrud at about 8000 feet. As soon as we step on this platform there is a transformation scene which brings us into Scotland.

It is one of the rare sanctuaries which the water-nymphs have been able to hide away in the arid stone-pit of the gods of the Duab. The grassy glade, swampy in parts, is strewn with lichen-covered blocks, between which flow shallow brooks of clear cold water amid banks and islands of beautiful flowers. Dark groves of thuyas surround the clearing on the level, which represents the last and lowest step of this morainic scenery, which rises towards the background in a series of gradients, forming a tasteful transition to the rocky wastes beyond. My photographs should describe better than any words the intimate charm of the moorland glen near our camp, where nature was allowed to show herself as a landscape-gardener of sweeter mood. Why does she wear this kindlier face? Because here the ground "holds water;" it is soaked with water, not merely traversed by a ditch. Old moraines have been left across the valley in waves and heaps; great falls of rock from the precipices have added their share. In the bowls and pans thus formed the glacier-water has accumulated, held back by the grit and clay in the moraines, or by the fine material which it had itself carried down and deposited in the clefts of the lower dams of loose boulders.

The latter process works from bottom to top, which explains that we find the more finished landscape on the lowest step. The site of Lailak Chapdara must have been a (shallow) lake, which gradually was filled up and changed into a bog and then luxuriant moor. It represents the last filtering of the glacier-stream; but hardly has it left this place of

* He calls the Laudan pass "Lailak;" Kossiakoff knew it as Rasi-Rabat.

purification, of peace, and beauty than it hurries on to join the common rush, and, like a reckless youth, throws itself into the troubled career of the Surkhab, which is full of mud.

Let us find the source of the Pasrud. We go through a thick forest where some of the dark trees are hung with branches of lovely roses. After a climb of about 300 feet we discover the first lake (No. 1), a shallow mossy tarn lying in deep shade below the sheer wall of Khontagh, garishly illuminated by the sinking sun. It receives and discharges visible streams. A hundred feet above it we meet three strong Pasrud sources which run down to supply the two rivulets which embrace the Lailak. Another 300 feet or so and we stand on the grand piles of tumbled blocks that make the lower shore of the largest lake (No. 3). Here we are in surroundings of a sterner character, reflected in the sombre waters over which the near mountains cast their gloom. When the light of midday brightens it, we can revel in shades of blue and green from the rich sapphire of the depths to the gay emerald of the algæ in the shallows near the shore.

To make our report quite accurate, let us also enumerate lake No. 2, which lies in a clean stony bed held between the sharp-angled screes of a recent landslide and a hump of moraine. It has no visible outlet, but receives the left and weaker branch of an open escape from the great lake. The right prong of this forked stream only sees daylight for 30 yards, and then sinks away. Attempting thus to trace the surface streams, we have obtained an insight into the complicated hide-and-seek of the waters. Some of it leaves the big lake ostentatiously and dives away suddenly or in the wider surface of a pool; some of it thrusts itself forward from underground.

Valleywards the big lake is fenced off by a ridge of rocks rising to 60 feet above its plane. Towards the interior is a moraine-dyke 200 feet high and spotted with stunted thuyas. Tracing an inlet at the eastern corner, we proceed on our search. Like a noble queen, the torchweed raises its golden sceptre above a host of tenderer plants that have already gone to rest, for we are now leaving behind the oozing sponge, that honeycomb of moisture between the great lake and the Lailak camp. Behind the dyke just mentioned the wanderer will march across a sort of irregular swelling, half a mile wide and long, which is also the width of the valley. This gentle rise is covered with numerous mounds or round heaps of astounding regularity. Small trees still flourish, and in a hollow near the screes on the right side is a colony of aspen. Near by shines a mirror, to which the stream, still above earth, will guide us. The floor of this lakelet is a grand sight to see. It gleams and glitters with the many hues and the brilliancy of a faultless opal. No more can I say; it is the truth.

Onward now to reach the higher and blacker dumps of the retired ice. Passing over a scree-fan from Khon Tagh, we imagine ourselves

walking on billiard-balls, so rounded are the edges of the stones, and that only from dry grinding. The stream, which is getting thinner and

IN THE ZARAFSHAN VALLEY.

thinner from constant losses, here issues from a spring amidst a waste of sharp-angled and striated limestones of many tints. Then a low

rampart, and then a very high one, dark, forbidding, crowned with a titan-boulder that hails us from afar. Between these two moraine waves is a lake, a basin of thick black ink in a hollow of ashen shingles. It is fed by a spurt issuing from the coarse rubbish-heap in front. There sprout a few long grasses, fading wolfsbane, and the stalks of the sorrel with their red, green-edged seed-vessels.

Hence we do not see water for a long time, but have to climb patiently for many hours over what may be described as a gigantic cataract of blocks disgorged into the narrow trench between the mountain-sides, a veritable pandemonium of broken stone. To our left we obtain a glimpse of the south-eastern aspect of Khon Tagh, an interminable flight of moraines and screes without a single speck of snow. Nothing but loose rubble, on which next day we spent six hours of steady plodding. In a moister climate, even under the same latitude, there would surely be *névé*.

At last we reach our goal at a height of 12,000 feet. We stand on comparatively level ground in the focus of a magnificent panorama of glacier peaks. Before us a grey lake. Its opposite shore is a gravel delta covered with a network of countless channels. On our side is a miniature Norway, formed by the labyrinthine rocks that fall away into fjords of deep water.

From the gullies of Chapdara descend the twin glaciers, the sources of the Pasrud. Their waters unite in the glacier-lake, secrete themselves in the block caves of its lower coast, and there begin their fanciful journey to the world below. The chaos of stone, of mountains firm and mountains shattered, is but thinly hung with that mantle of snow and lacework of ice which so royally clothes the shoulders of Swiss and Caucasian monarchs. My general impression is, taking things all round, that thickness and extent of the *névé* seems very poor, which indicates that the scorching breath of the desert is also here. Seeing what I see here, I am not so sure that a covering of snow and ice has not a preservative effect as contrasted with the weathering of the naked ribs of the Duab.

But of course these are second thoughts, the outcome of reflection that compares, not of immediate vision. This means that the effect of climate on the view begins to pale before a wider influence. Vegetation we do not expect in any case; the most familiar factor of comparison is ruled out, and that makes the lofty mountains of the world akin. Two things only are seen—rock and snow. Therefore the landscape is truly Alpine, a cloudless day in a high limestone range.

We know that the great snow-domes as seen from the valley present the same appearance at all seasons, and if we let our thoughts soar higher still, to regions where no human foot has gone, or higher yet, where even mountains but aspire, there may be said to be a realm of air beyond all climates and all seasons, like the bottom of the sea.

GORGE OF THE FAN ABOVE PITI.

There the shifting scenes of desert and garden, of the battle of the stones and of the wind-borne crystal, fade and merge into the cold of the outer sphere.

Before the paper, the CHAIRMAN (Mr. DOUGLAS W. FRESHFIELD, Vice-President): I have, in the first place, to express the regret, which I am sure will be shared by all present, that our President has not been well enough to take the chair to-night. He has asked me to take it in his place. We have to-night two travellers* present—a double entertainment. I need not introduce to this meeting Mr. Rickmer Rickmers. Many of you will remember that nearly eight years ago, in November, 1899, Mr. Rickmers read us a paper on some of the results of his journeys in the province of Bokhara, the paper being accompanied with many excellent photographs which illustrated those physical features of the Earth in the investigation of which he has taken so much pains. Since then Mr. Rickmers, accompanied as a rule by his intrepid wife, has made many journeys in various mountainous regions both in Europe and Asia. With the Alps he has long been familiar; he has been one of the principal instruments in introducing into them that practice of ski-ing which has now become not only a European sport, but in the French and Italian armies a military exercise. He has led a party into the heart of the Caucasus, which accomplished there the most extraordinary feats of mountaineering, and he has ascended Mount Ararat. But he has devoted himself more especially to the exploration of the region which he calls the Duab, the mountain cradle of the Oxus and the Yaxartes, a district of the greatest interest, not only to the geographer, but to the student of the human race. Mr. Rickmers is more than what is sometimes called with contempt in scientific circles a mere mountaineer. He is a skilled observer and student of physical geography, and from this point of view he hopes to devote several years to the investigation of the physical features and the glaciation of the mountainous regions of which Samarkand is the centre. As he means to reside in Samarkand for several months in the year, he will be most favourably situated for carrying out the work on which he has set his heart. In this work Mrs. Rickmers, who in the past has been his most devoted and useful assistant, means to co-operate, and I hope that to-night, as at the meeting in 1889, she will favour us with some of her own experiences, particularly her experience, say, at a height of 20,000 feet above the level of the sea. Our second traveller is M. Borisoff, a Russian artist, who is now holding an exhibition in London. Since we have already had a discussion of the scientific results of Mr. Rickmers' journey at a recent Research Meeting, the slides taken from M. Borisoff's interesting drawings will be shown on the screen after Mr. Rickmers' paper. I may, before I sit down, point out that our visitors to-night are linked by a common object—they are both lovers of the regions of ice and snow. M. Borisoff, it is true, takes his ice and snow in allopathic doses in the polar regions, whilst Mr. Rickmers, like myself, takes his homœopathically in those silver heights which rise "islanded in the immeasurable air" above the pines of the temperate zones or the palms of the tropics. There is yet one more link between the two travellers—both have travelled within the limits of the Russian dominions. I am glad to have this opportunity formally to acknowledge, both on my own behalf and on that of this Society, the

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* M. Borisoff, a Russian artist, who has spent some years in Novaya Zemlya and the Samoyede country, exhibited a series of slides reproduced from his pictures of Arctic scenery and life.

constant courtesy and the great facilities which have always been extended by the Russian Government to all properly accredited scientific travellers of whatever nationality. I have myself profited by these facilities in the Caucasus in the course of three journeys. I not only was given every practical aid in travelling, but I was allowed to use all the Government surveys, some of which were not published. I was even allowed the surveys that were in the making, sometimes still in manuscript, and it was entirely owing to these facilities that eleven years ago I was able to give the public of Western Europe the first authentic map of the glaciers of the Central Caucasus. And, turning to an earlier period, when I was one of the Hon. Secretaries of this Society, I had many occasions to observe how English travellers penetrating into further Asia were helped by the Russian Government. I will only cite one instance, that of Mr. and Mrs. Littledale in the very remarkable journey that brought them almost to the gates of Lhasa. In that journey they started from a Russian base. We geographers and men of science are indebted to the Russian Government for having recognized that it is not to the advantage of a great and civilized state to place obstacles in the way of the pursuit and progress of geographical knowledge; but that, on the contrary, such a policy would be unworthy of a wise and philosophical and liberal-minded statesman. I will now call upon Mr. Rickmers to read his paper.

After the paper, the CHAIRMAN: Although we shall not have time for any discussion, I am sure we should all like to hear any observations Mrs. Rickmers may have to make on the paper we have just listened to.

MRS. RICKMERS: I remember on the last occasion I had the honour of speaking here I discussed the hardships of such a journey from a woman's point of view. I need not, therefore, dwell on that side of the subject again except to say that I never am so well as when engaged in travel of this sort, and the eight years which have intervened since the last occasion have in no wise diminished my capacity for enduring the hardships of such a journey. I look upon it, in fact, as a kind of rest cure for the nerve exhaustion induced by Western civilization. My husband has spoken of the help we gave him in taking the photographs, but there is another side of our activity which he has left unnoticed—I refer to our administrations to the lame, the halt, and the blind in season and out of season. We undoubtedly relieved him of a considerable amount of work in this direction, for whereas he was in the habit of recommending an application of brilliantine for all sorts of ailments, we really attempted some diagnosis of the cases brought to us, and nothing could exceed the kindness and skill with which we anointed and bound the poor sufferers wounds. The inhabitants of Bokhara are apparently far less susceptible to germs than a more highly civilized people, and I may say that our suggestion to one that he should bathe his eyes was rejected with contempt, though the doctor at the hospital gave him the same advice, which, let us hope, made more impression. The chairman asked me to tell you of our journey to a height of 20,000 feet. In the last half-hour was concentrated the greatest physical discomfort I have ever experienced. My hands and feet were numbed, and from the summit there blew such a breeze of icy coldness, that, as I say, I was absolutely miserable. It may be a fine thing to be at a height of 20,000 feet, but I felt very glad when we turned back.

The CHAIRMAN: I have now to introduce to you our second traveller, M. Borisoff, a distinguished Russian artist. M. Borisoff has had a most interesting career. Brought up amid peasant surroundings, at the age of fifteen he was sent by his parents on a pilgrimage to the Solovetsky monastery on the White Sea to return thanks for his recovery from illness. There he fell in love with the Arctic Regions, and shortly afterwards developed a passion for art. To gratify these tastes, he

returned to the monastery at the age of eighteen, I believe without the knowledge of his parents, and worked in the shop attached to it in the production of the sacred pictures and icons which you see all over Russia. A Grand Duke fortunately came that way, and recognizing the artistic talents of the youth, provided for his artistic education at the Academy of St. Petersburg. After that his career was decided by the patronage he received from Count Wittwe and the members of the Imperial family. He obtained the means to go and study his subject in the Arctic Regions. He set out in a yacht and sailed about the coasts of Novaya Zemlya, and thus gratified his ambition to become the painter of the Arctic Regions, as M. Loppé is the painter of the High Alps. And now we are able to look on reproductions of many of his realistic and very accurate sketches or impressions of the regions of snow and ice, of the tundras of the far north and the shores of Novaya Zemlya. I only regret that, as he does not speak English, he will not be able to explain them, or give the names of them, himself, therefore if I fail in giving them from this list, I hope you will excuse me. These slides are all taken from paintings made by M. Borisoff, and I am told they are taken by the three-colour process.

[The slides were then exhibited, Mr. Freshfield giving the explanations.]

The Chairman: That brings to a conclusion the series of slides M. Borisoff has been good enough to bring here, and I am sure you will all agree with me in according a very hearty vote of thanks both to Mr. and Mrs. Rickmers and to M. Borisoff for the instruction they have given us this evening. I think there can be but few meetings at which we have had a more continuous and richer entertainment than has been afforded us to-night.

The following discussion took place at the meeting of the Research Department:—

Dr. Strahan: This has been an extremely instructive series of slides, and I am glad to have had the opportunity of seeing them. The evidences of former glaciation on a much larger scale than that of the present day have been brought out in a most remarkable manner by these views of moraines. I was especially struck by the manner in which the morainic material may be spread out in the form of a flat bottom to the valley. It has long been a puzzle to me to know in what form the ice last lingered in our valleys in England, and more especially in Wales and Scotland, and where the last remnant of the sheet was situated before it dwindled away to nothing. So far as regards terminal moraines of valley-glaciers, we have none, except perhaps in our most mountainous regions; over a great part of the country we have none. But we have enormous flat stretches of gravel along valleys, as well as a tumultuous deposit of gravel which is not confined to valleys. Anything that will throw light on the distribution of these in our country is greatly to be desired. But I have accepted your invitation to speak merely for the purpose of expressing the great pleasure with which I have seen these photographs.

Mr. Douglas Freshfield: Mr. Rickmers' treatment of his subject this afternoon has been too geological for me to make any remarks that would be of value. The first impression the photographs give to one who has seen many mountains, is that from a picturesque point of view the region under notice is hideous. But mountains denuded of protective vegetation may be extraordinarily instructive from the geological point of view. The only mountains I have seen denuded and torn in this way by water-action are those in North-Western Persia, on the Araxes. With regard to the views on the Zarafshan glacier, the pocket-lakes in the ice reminded me of the glaciers of Kanchenjunga, the lower portion of which corresponds with the description given by Mr. Rickmers of Central Asian glaciers. With regard to the retreat of the ice, that of course is another proof that a retreat of the

ice has been going on all over the globe during the last fifty years. How great it has been in the Alps, there are few who can realize better than I can. I saw the Swiss glaciers when I was a child, and the retreat in many cases must have been over a mile. As to the character of the surface left after a glacier has retreated, I think perhaps the finest example in Central Europe must be that at the lower end of the valley of Aosta, where the enormous moraine of the old glacier of Mont Blanc protrudes in a great mound for some 12 miles beyond the Alpine foothills, enclosing an area somewhat higher in level than the rest of the Piedmontese plain. For any one who wants to study the work of a prehistoric glacier, there is no better place in Europe than the neighbourhood of Ivrea.

Prof. Watts: There is not very much that I can say except to congratulate the Department on the marvellous and most interesting series of views that it has had an opportunity of seeing. Those who have had a large experience in dealing with geological and geographical photographs will have found how difficult it is to secure such points of view as will show large features on the scale on which Mr. Rickmers has succeeded in showing them. In the abstract of the paper he modestly disclaims doing anything more than collecting facts for others to deal with; but I am sure every one here will agree that it requires no mean skill to have not only selected the points of view, but to have explained so many of the difficulties encountered. To me, as a geologist, the photographs open one's eyes to very grave difficulties. In this region there is very rapid denudation going on, more rapid than would be expected *à priori* in such a dry climate; and in consequence a great number of deposits of different characters are being laid down, moraines at one point, alluvial at others, solidified mud-streams and shoot-cones, as well as the ordinary screes, gravels, and wind-drift. Now, we have in parts of England old rocky landscapes filled up and coated over with deposits of a similar nature. The Permian breccias are somewhat like screes, the pebble-beds like old shoot-cones, and the other deposits shown to us are more or less like members of the Trias; but what is brought out by this paper is the complex relationship of deposits which must exist under those smooth coatings of Trias which form the floor of the Midland Counties.

Sir Martin Conway: There are only two points that I think I might refer to in connection with this very interesting series of slides we have seen and the remarks made. The first is about the surface of the glacier referred to, and its similarity to that of the big glacier of Kinchenjunga. It exactly resembles the two great glaciers of the Hispar and the Baltoro—the same great pools, with the steep sides leading down into them, and the endless succession of them, and the enormously thick load of moraine all over the surface of the ice. I was particularly interested by what I think any traveller in those regions must notice who pays attention to causes and effects—the enormous development of the mud-avalanches in those parts. The mud-avalanches in Mr. Rickmers' country do not seem to have attained so great a development as they do south of the main range. Where I was, all through Nagar and Hunza, the mud-avalanche is by far the most important agent in forming the miscellaneous deposits you meet with in the valleys. The moraines, even though enormous, are secondary, and are not so big as the enormous deposits produced by mud-avalanches. These mud-avalanches do not come at odd times; they have their definite periods; practically all of them fall within a fortnight; they are not produced by rain, but by the melting of the winter snow. Probably those I saw were larger than those Mr. Rickmers saw. I was present one day when some 150 of them fell, over a single broad hillside; and I could see that hillside from bottom to top, from the bottom where it reached the rapid Nagar river, away up to the top where it was above the snow-line, a vast slope of rock seamed by an infinite number of

gullies, and about 10,000 feet in height. The snow was melting very rapidly all over the upper surface; water was trickling and pouring down every one of its little upper gullies, which were very numerous. These gullies run together, like the branches of a leaf, uniting to form a few main gullies down below. Down these gullies all day long the mud-avalanches were being discharged, and they came down in a puzzling fashion. I stood by one of these gullies for more than an hour, —and five avalanches passed. Each took about five minutes to go by. I measured the size of the gully and the amount discharged, as well as I could, and recorded it in my book at that time. They started at the top as very little falls, and then by the mixing of the water and the snow with the *debris* that they picked up on the way, and the rocks and rubbish that fell into them, formed a little dam in the gully, and behind that dam the stuff collected till it burst the dam. Then the thing fell further, and clogged and formed a dam lower down, so that there was a continual formation of dams and bursting through of them, and each time the stuff collected it was larger in amount in proportion as it was formed lower down. I saw one of these dams formed and burst quite low down, and the amount of stuff that was held back, and then the enormous discharge that came when the dam burst, enabled me to judge of what was possible in that way. The sides of the gullies in this case were constantly falling in, not falling out, and pieces of rock, 6-feet cubes and larger, were carried down as though they were corks in this stuff. They rolled over and over, and fell at last into the bottom of the river below. For a day or two after that, we passed along the foot of what I may call, roughly, parallel gullies cut more or less in the same long range of mountains, and down every one of them we saw the traces, not yet dry, of mud-avalanches that must have fallen about the same time, so I take it that where we were, in the Hispar valley, and on the other side of the mountains (for we found, a few weeks later, that traces of mud-avalanches were plentiful there), somewhere about that time, which I think was early in July, these mud-avalanches were being discharged over the whole district, and the volume of *debris* that they must have brought down in the fortnight was enormous, far greater in proportion than anything carried by the glacier in a similar length of time.

Sir Henry Trotter: I am afraid I have nothing to say on the geology of the subject, but perhaps I may make allusion to the most excellent and realistic photographs which have been shown to us, and which reminded me very much of what I saw myself some thirty years ago in Tibet and in the Pamirs; I seemed to find myself at home at almost every step. I only mention this as a tribute to the excellence of the photographs. As regards the mud-avalanches, I may say that the pictures forcibly reminded me of what I saw only a few weeks ago in the neighbourhood of Naples. The plain was covered with snow, out of which protruded a narrow, dark, and tortuous stream of large blocks of lava, the outcome of the last eruption of Mount Vesuvius—and resembling in appearance, and somewhat in character, the mud-avalanches which have been so accurately described by the last speaker.

The Chairman: I think you will agree with me, gentlemen, that we owe a very hearty vote of thanks to Mr. Rickmers for the very excellent lecture he has given us, and especially, if I may say so, for the excellent lantern slides. I hope next time he comes back he will give us slides prepared on the three-colour process, which, I am sure, would be extremely interesting. I ask you to pass a hearty vote of thanks to Mr. Rickmers.

DR. STEIN'S EXPEDITION IN CENTRAL ASIA.*

After despatching from Abdal a caravan to Kashgar with most of the archæological "finds" brought away from the ancient sites north and south of Lop-nor, I started in the last week of February towards the oasis of Sha-chou, better known by its old name of Tun-huang, on the westernmost border of the Chinese province of Kan-su. The route taken by us through intervening desert may claim special historical interest. It was the same which Marco Polo had followed, and by which, six centuries earlier, Hsüan-tsang, the great Buddhist pilgrim, had made his way back to China from Lou-lan, the present Charklik. Ever since the second century B.C., when the Chinese first extended their influence into Turkestan, this desolate desert track, close on 350 miles in length, had been an important caravan road during successive periods of their supremacy in the Tarim basin. Yet for centuries past it had been almost completely forgotten. Rediscovered some twenty-five years ago, it is just now coming rapidly into favour again with traders from Khotan and Kashgar, probably as a result of the commercial tide attending the increased prosperity of the oases in the south of the great Turkestan desert. It was interesting to note that a large part of the goods which those enterprising pioneers import by this ancient road to Cathay, consists of English fabrics brought all the way from Kashmir on pack-animals. Marco Polo's description of the route was found thoroughly accurate in all its topographical details. But with men and beasts accustomed by the winter's work to even more forbidding ground, we managed, in spite of the trouble arising from salty springs and scanty grazing, to cover the distance, which he reckoned at twenty-eight marches, in seventeen, with two days added for halts.

The ground traversed proved of considerable and varied geographical interest. For more than one-third of the route we were skirting the shores of a vast salt-covered lake-bed, indicating the extent of the Lop-nor marshes at a period, perhaps, not very remote. Beyond, the detailed survey carried along the route by Surveyor Rai Ram Singh showed clearly that the well-marked depression between the slopes of the Kuruk-tagh and the Altyn-tagh in which we moved had once served for the passage of the waters of the Su-le-ho and Tun-huang rivers down to the Lop-nor. Where this valley expands eastwards we came upon ground very puzzling at first sight, not only to the traveller, who runs a risk of losing his track here with ease and serious consequences, but also to the topographer. Surrounded to the south by high ranges of dunes, and to the north by the absolutely barren gravel slopes of the Kuruk-tagh, there extends a wide basin containing unmistakable dry

* Communication from Dr. M. A. Stein, dated "An-shi, Kansu, June 18, 1907."

lake-beds, and between and around them a perfect maze of high clay terraces remarkably steep. The lake-beds, salt-covered in part, looked distinctly recent. Yet the lake, shown as Khara-nor in the maps, in which the Su-le-ho and Tun-huang rivers were hitherto supposed to end, and from which alone sufficient water could come to fill this great basin even temporarily, lay still fuller a degree to the east. It was only in the course of the subsequently resumed surveys that we discovered that a considerable river flows out of the Khara-nor during the time of the spring and early summer floods, and, after draining some smaller lakes and marshes lower down, carries its waters nearly 60 miles further west into the desert. The very deceptive way in which its deep-cut bed and earlier, now dry river channels are masked by what looks an unbroken flat glacis of gravel, accounts for the error of former maps. The curious clay terraces proved to have their exact counterpart in formations found about the shores of the Khara-nor, and probably due to the successive action of water and wind erosion.

It was soon after emerging from this great depression at a point still five long marches from the edge of the Tun-huang oasis, that we came upon remains of ruined watch-towers and an ancient wall, or *agger*, connecting them. A variety of archæological indications, rapidly gathered as we passed along them, convinced me that they belonged to an ancient system of frontier defence corresponding to the extant "Great Wall" on the Kan-su border. The wish to explore it in detail induced me to return in the second half of March to the still wintry desert as soon as men and animals had recovered, by a short halt at Tun-huang, from the fatigues and exposure of the preceding journey. By moving first to the north of the oasis, and subsequently striking the ancient *limes* by a new route through the desert west of Tun-huang, we succeeded in accurately surveying its line right through for a distance of some 140 miles, and exploring the ruins of its watch stations, sectional headquarters, magazines, etc. From the Chinese records, mostly on wood or bamboo, which the excavation of almost every ruin yielded in plenty, I was soon able, with the help of my indefatigable and scholarly Chinese assistant, Chiang-sieh, to make certain that this frontier line was constructed at the close of the second century B.C. under the emperor Wu-li, who commenced Chinese expansion into Central Asia. It appears to have remained regularly garrisoned down to the middle of the second century A.D. Dated documents are particularly numerous from 98 B.C. to about 25 A.D., the time when a period of internal and external troubles came to an end with the advent of the second Han dynasty. There can be no doubt that the main purpose of the *limes* was to guard the territory south of the Su-le-ho river, which was indispensable as a base and passage for the Chinese military forces, political missions, etc., sent to extend and consolidate Chinese influence in the Tarim basin and further west. The enemy whose attacks had to be warded off were the Hsiong-

nu, the ancestors of those Huns who some centuries later threatened Rome and Byzance.

In the west we traced the fortified *limes* to its very end where, after a great bend to the south-west, its flank rested secure on extensive salt marshes and equally impassable mountain-like ranges of drift sand. Eastwards I could follow its line to the oasis of An-shi, from where it is likely to have extended to the present Kia-yü-kuan gate of the "Great Wall." The fact that almost the whole of the line from An-shi to the west passed through what was already in ancient times an absolute desert, broken only at intervals by belts of scrub and thin jungle near the rivers or marshes, has, no doubt, helped to save the ruins from destruction, such as always threatens remains in inhabited areas. But a still greater share in the remarkably good preservation of the antiques excavated, and of structures showing but little apparent strength in their materials, must be ascribed to exceptionally favourable conditions in the climate and soil of this desert. The latter can have seen but extremely scanty rainfall for the last two thousand years, and in most places but little erosion by driving sand; for the hundreds of inscribed pieces of wood, bamboo, silk, and the mass of miscellaneous antiques had survived almost uninjured even where covered only by the thinnest layer of gravel or *débris*. Sometimes a mere scraping on the surface sufficed to lay bare files of records thrown out before the time of Christ from the office of some military commander on to a rubbish heap, in which even the most perishable remains, straw, fragments of clothing, etc., looked perfectly fresh.

The Chinese documents, of which close on two thousand were recovered, refer largely to matters of military administration, often giving exact details as to the strength, movements, etc., of the various corps distributed along the border; arrangements about their supplies, equipment, etc. Others are private letters addressed to officers, full of quaint actualities, etc., or official reports. Together with the remains of the quarters, furniture, arms, etc., excavated, they will amply suffice to restore a picture of the life once led along this most desolate of borders. One of the best preserved ruins is that of an imposing magazine, forming a solid block of halls nearly 500 feet long. Apart from the Chinese records, I recovered very interesting relics of the traffic from the west once passing along the line guarded by the *limes*, in the form of silk pieces inscribed with Indian, Brahmi, and Kharoshthi, and in a number of letters found carefully fastened, containing writing in an early Aramaic script but possibly Iranian language. Most of these turned up along with the Chinese records of the time of Christ. Can they have been left behind by early traders from Persia or Western Turkestan coming for the silk of the distant *Seres*?

These explorations, which kept us busy well into May, had for me the special attraction of combining geographical and archæological

interest. Desiccation within historical times, on which Mr. Huntington's recent investigations in Turkestan have thrown so much fresh light, has left quite as distinct traces in the Tun-huang region as throughout the southern part of the Tarim basin. We could scarcely wish for a more accurate gauge by which to estimate the extent of the physical change that has thus taken place in this part of Asia within exact chronological limits, than this border-line drawn through the desert by Chinese engineers in the closing years of the second century B.C. The ground it traverses has remained wholly untouched by the manifold and often complex factors connected with human activity in the shape of irrigation, etc., which affect inhabited areas, and there is plenty of evidence to show that those who laid down the line, selected the positions for watch-stations, etc., had been guided by a sharp eye for all surface features and their practical advantages. By closely studying their work, a great mass of important observations could be gathered. In the many places where the flanks of wall sections rested on marshes or small lakes, it was easy to ascertain the fall in the water-level, distinctive enough, but nowhere excessive. The materials which had been used in the construction of the *agger*, a rampart of gravel or clay cleverly strengthened by regular layers of fascines, afforded tangible evidence as to the vegetation then to be found along the various depressions. From the extent and character of the damage, due to wind-erosion, which the different sections of the wall, the watch-towers, etc., had suffered, definite conclusions could be drawn as to the force and prevailing direction of the winds which still blow over this desert with remarkable violence and persistence. Coming mainly from the east and north-east, they make their effort felt to a marked degree far away in the Tarim basin, as I have had ample occasion to observe in the climatic conditions and surface formations about Lop-nor.

We suffered a good deal from these daily gales and the extremes of the desert climate. Against the icy blasts, continuing well into April, our stoutest furs were no adequate protection. On April 1 I still registered a minimum temperature of 7° Fahr. Before the month was ended the heat and glare had become very trying, and whenever the winds ceased clouds of mosquitoes and other insects would come forth from the marshes near which we had to camp for the sake of water, to torment man and beast. Scorpions also abounded. The salty water was another source of trouble. When the excavations were completed by the middle of May, it was time to return to the oasis. I never ceased to wonder how, under such conditions, we managed to the last our Chinese labourers at work, all opium-smokers, and of considerable *vis inertiæ* like most of the people of Tun-huang.

About the archæological labours which have kept me fully occupied since at old sites to the south of the oasis, the briefest reference must suffice for the present. At the Buddhist cave temples, known as the

"Halls of the Thousand Buddhas," they revealed a great series of fine frescoes and stucco sculptures, going back mainly to the eighth and tenth centuries of our era. Together with abundant other remains, they attest the highly flourishing condition which Buddhist art and studies, imported from India, both through Central Asian and Tibetan channels, had, from an early date, attained here on purely Chinese soil. The materials collected are so ample and varied, that they will require prolonged labour on the part of several specialists.

Everywhere about the oasis I was able to observe the far-reaching effects which the devastation and loss of population attending the last great Mohammedan rebellion have had on the cultivated area. Taking into account the prevailing physical conditions, it appears improbable that the lands then abandoned to the desert on the outskirts of the oasis, will ever fully be recovered again for human occupation. Again and again I came upon such ruins of recent date which drift-sand is steadily invading. There is more than one "old site" in formation here which might well be ear-marked—for the archæologist, say, of 4000 A.D.

I am now starting along the foot of the mountains towards Su-chou, from where I hope, if time and local conditions permit, to effect surveys, both along the Great Wall north of this corner of Kan-su and in the Nan-shan range southwards during the summer and early autumn.

[In a later letter, dated July 10, Dr. Stein writes—]

Since sending you the last account of my doings, I have been able to carry on interesting survey work in the Nan-shan ranges south of the An-shi and Yü-mên-hsien. It was very pleasant to get near the snows again. They are plentiful on the main range, which has peaks rising to 21,000 feet and more. We have taken many heights by mercurial barometer and clinometer, and I hope the mapping done will be of geographical value even after the labours of the Russians. The physical conditions prevailing on the successive plateaus by which the Nan-shan rises from the Su-le-ho basin offer many curious features explaining formations in the desert below. Near Chiao-tzü I surveyed an extensive old site deserted six or seven hundred years, which reproduces most strikingly the changes undergone by the ground about the ancient sites north of Lop-nor. The same powerfully erosive east wind has been and is still at work at these widely distant places.

THE COURSE OF THE UPPER IRAWADI.

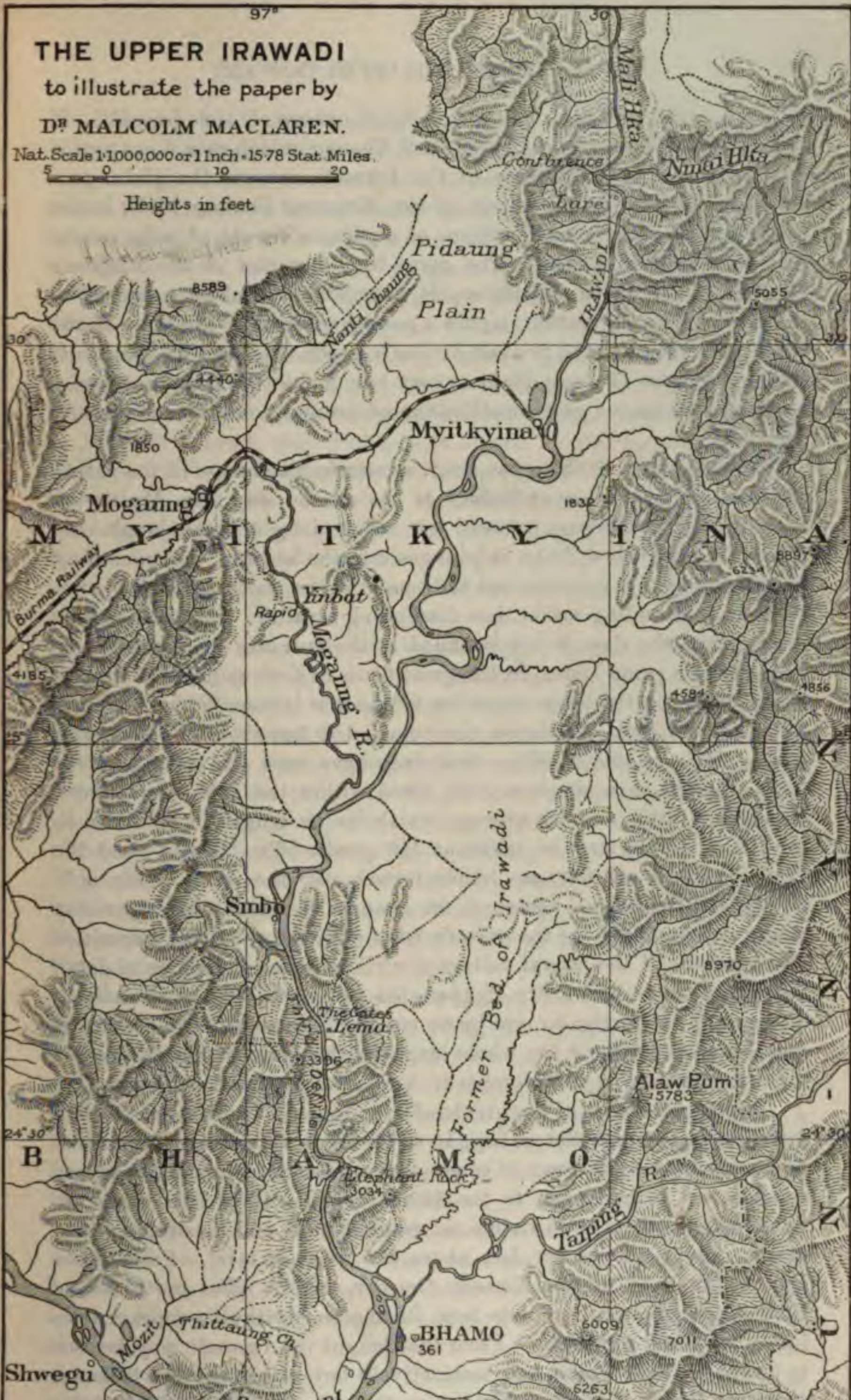
By MALCOLM MACLAREN, D.Sc., F.G.S.

The present note deals with changes of recent date, geologically speaking, in the course of that portion of the upper Irawadi that lies between the Confluence, marking the northern limit of British "administered

territory," and the village of Shwegu, some distance below Bhamo. This portion of the Irawadi, together with the lower reaches of its two great affluents, the Mali Hka and the 'Nmai Hka, uniting at the Confluence, were traversed during the cold season of 1905–6 by the present writer in the course of an examination of the auriferous alluvial deposits of Burma. The upper waters of the affluents in Hkamti Löng have been seen by two or three travellers, and have been crossed only by Prince Henri d'Orleans on his arduous journey from Tongking to Assam, and more recently by E. C. Young. To visit their lower reaches, even in the vicinity of the Confluence, necessitates the employment of a strongly armed escort, and no explorer has yet succeeded in reaching the Hkamti valley by way of these streams. So far as they were ascended on the present occasion they lie in a deeply dissected mountainous region, the stronghold of the truculent Kachins. The old river-terrace on the flat tongue formed by the junction of the two rivers at the Confluence, the deep, narrow valleys, and the numerous rapids, all indicate streams still engaged in deepening their beds, and at this stage full of virility. On the Mali Hka, the western affluent, long shallow reaches with fast-flowing waters alternate with pebbly rapids. This branch, therefore, presents no insurmountable obstacle to canoe traffic. The 'Nmai Hka, on the other hand, as indeed its Kachin name would indicate (*'Nmai*, "bad;" *Hka*, "water"), offers serious impediments. It flows over Miocene ash-beds, whose strata of unequal hardness, yielding most irregularly to corrosion, have produced dangerous bars with narrow and tortuous rock-bound channels, through which the whole volume of the river rushes.

From the Confluence, and after a preliminary bend near Lapé, the river flows south in a fairly straight line to Myitkyina. Its current is still too rapid to permit of the deposition of anything but coarse gravel, and since the valley is narrow a natural sluice is formed here. It is, therefore, in the heads of the long reaches and on the bars in this portion of the river that gold has been deposited and concentrated in sufficient quantities to warrant gold-dredging, an industry now being vigorously developed. At Myitkyina, the British administrative post farthest up the Irawadi, the river may be fairly said to have left the Kachin hills. Its channel immediately widens to some 800 yards, and from Myitkyina to Sinbo, 72 miles by river and only 48 in a straight line, the Irawadi has almost reached a temporary base-level, as, indeed, the figures themselves would indicate. Its valley bottom, only half a mile to a mile wide above Myitkyina, has broadened to 16 miles. Its deposits are no longer gravel, but fine sand and mud.

To the north-west of Myitkyina lies the Pidaung plain, a broad savannah covered with tall *kaing* grass, the haunt of gaur (*Bos gaurus*) and tsine (*Bos sondaicus*). Its origin is obscure, for there is now no stream running through it capable of cutting it out, or of



THE UPPER IRAWADI
to illustrate the paper by
Dr. MALCOLM MACLAREN.
Nat. Scale 1:1,000,000 or 1 Inch = 15.78 Stat. Miles
Heights in feet
Mali Hka
Nmai Hka
Confluence
Pidaung
Plain
Nanti Chaung
IRAWADI
Myitkyina
Mogaung
Burma Railway
M Y I T K Y I N A
Yinbot
Rapid
Mogaung R.
Former Bed of Irawadi
Sinbo
The Gates
Lema
Alaw Pum
5783
B H A M O
Elephant Rock
Taiping R.
BHAMO
361
Mozit
Thittaung Ch.
Shwegu
R. IRAWADI
Sinkan
97°
8589
1850
4185
5055
6009
7011
6263
8970
4584

filling it when cut out, nor is it a filled oxbow of the Irawadi. It seems possible, however, that the Nanti Chaung, which now flows southwest to Mogaung and thence to the Irawadi, cut out the plain, possibly also assisted by the waters of the Mogaung Chaung itself, before their "capture" by a small stream at a point a couple of miles north-east of Mogaung station. The gorge-like character of the Mogaung Chaung at this place and its rapids near Yinbat lend some support to the view. The suggestion implies a partial reversal of the slope of the Nanti valley, but as the present divide between the head of the Nanti Chaung and the Pidaung plain is very low, and as the rock is an easily eroded sandstone, no great modification of present conditions is thereby demanded.

Turning again to the great river, a remarkable change in the nature of its valley takes place at Sinbo. It has all the way from Myitkyina been quietly meandering between low banks along a broad jungle-clad plain. A mile below Sinbo it plunges into the heart of the mountains, everything at this point, except the course of the waters, giving the impression of ascending rather than descending a valley. Half a mile wide in the plain, the river is now confined at the entrance to a channel no more than 50 yards wide. In the great floods of the "rains," the turmoil of the waters in the basin above the entrance is indescribable. Even at Sinbo, a mile back, the waters rise 80 and 100 feet above the low-water mark. It is related at Sinbo that they have been known to rise the former height in a single night. Once within the defile the channel broadens a little, and its average width for its length of 30 miles in the Third Defile may be taken at 150 yards. The "Gates" and the Elephant Rock are narrows, in the former case the width being only 50 yards. The general course of the channel is straight, but the valley ridges coming down to the water's edge with the *en échelon* disposition characteristic of the lateral valleys of virile streams, its course in detail is most tortuous, and sharp right-angled turns, yielding most exciting moments to the navigator, are by no means uncommon. The channel is rock-bound throughout the whole length of the defile, and is practicable for steamers only from November to April, the season of low water.

Twelve miles east of the great defile, and parallel with it for its total distance, is an open flat valley, 10 to 12 miles wide near Bhamo, and untenanted by any stream of consequence. East of Sinbo it is nearly as wide, and is there open to the broad Irawadi valley. Its levels are unknown, but there is no visible ridge at the head, and the divide, if one exists, can be only a few feet above the Irawadi level. From Alaw Pum (5783 feet), on the Yunnan frontier, and 28 miles north-east of Bhamo, the whole valley plain from Bhamo to Myitkyina appears absolutely level and unbroken. From that height the Irawadi may be seen to disappear near Sinbo, and instinctively but vainly the eye looks for its silver thread in the broad valley on the hither side of the Sinbo hills.

Yet it has obviously flowed along that valley at no very distant time. Why, then, has it deserted it to flow through mountains 2500 to 3500 feet high, and mountains composed, not of soft rocks, but of metamorphic schists? The answer is that the Irawadi waters have been "captured" by one of its own tributaries—a case, indeed, of "domestic piracy," to use the confused, but generally accepted, American phraseology.

An examination of the topographical features of the country of the Third Defile reveals the history of the capture. When the Irawadi in former days meandered peacefully beneath the Yunnan frontier hills, a tributary stretched from near Bhamo northward into the hills for a distance of some 30 miles. Beyond its head a stream flowed northward to join the Irawadi near Sinbo, as is shown by the general northerly direction of the tributary valleys. Near the Kachin village of Lema was the col. As both streams cut back their heads, the col was lowered until the waters of the Irawadi at high flood burst over it, and, hampered by the lack of grade due to the meanderings on its old flood-plain, gladly seized and deepened its new channel. It became, indeed, locally rejuvenated.

Below Bhamo also there have been changes, though none so striking as the foregoing, probably the most notable case of "domestic piracy" that modern rivers may show. Nine miles west of Bhamo is a broad gap in the hills, through which the Irawadi formerly flowed. It was at that time that the coarse gravels of the Mozit Chaung and Shwegu were deposited. The course of the old river-bed is now occupied by the Thittaung Chaung. Here again there appears to have been domestic piracy, though the evidence is far from being as conclusive as in the Third Defile. The waters of the broad Irawadi valley seem to have been tapped near Sinkan by a small tributary, and there resulted the Second Defile, neither so long, so grand, nor so dangerous as the Third, but infinitely more beautiful.

The movement of the Irawadi channel at the Third Defile has been westward. Seeing that Chindwin river, also meridional in its course, closely hugs the western edge of its valley and leaves a plain on the east, some support might here be obtained for Ferrell's theory of the westward tendency of river channels in the northern hemisphere, a tendency supposed to arise from the retardation of the waters due to the Earth's west-to-east rotation. That the movement of both should be in the same direction is merely a coincidence, for the Chindwin is certainly moving west with the dip of the Miocene sandstones, along the strike of which it flows. It affords, therefore, an example of "monoclinal shifting." In any case, either on the Chindwin or on the upper or lower courses of the Irawadi, lateral movement due to retardation cannot, as Gilbert long ago showed for another region, take place so long as the rivers are silt-laden, and of the rivers of the world the Irawadi is at the present time the second greatest silt-bearer.

THE VALLEYS OF THE HIMALAYAS.

By R. D. OLDHAM.

A RECENT number of *Petermanns Mitteilungen* is devoted to a contribution* to the study of the origin of the existing geography of the Himalayas by Dr. K. Oestreich, who accompanied Dr. and Mrs. Workman in their expedition to the Central Himalayas as topographer in 1902. The paper contains the record of many observations of interest, especially as regards the so-called plains of Deosai; his description and photographs of this district leave no doubt, in accepting his conclusions, that the existing relief must have originated at a much lower level than the present elevation of the region, which is characterized by broad open valleys and a comparatively small height of the intervening ridges of hills, and is in process of conversion to the deep-cut valleys and high hills of the outer Himalayas.

Besides giving an account of his observations, Dr. Oestreich devotes the concluding section of his paper to a discussion of the vexed question of the origin of the Himalayan drainage system, and gives a detailed account of what he conceives to be the history of its development. It would be unprofitable to discuss these views, which are necessarily speculative and merely a modification of those already published by others in detail, but a review of the present state of the question cannot be without profit, in view of the interest of the problem.

The two leading features to be explained are, firstly, the fact that two great rivers rise within a short distance of each other, on the northern side of the line of highest peaks, and, after flowing parallel to the range, turn abruptly to break through it and escape southwards as the Indus and Brahmaputra rivers. The second is the fact that most of the great rivers, flowing southwards from the Himalayas, rise to the north of the line of highest peaks and break through it in deep and narrow gorges.

The earliest explanation attributed the valleys to gaping fissures, opened by forces acting in the interior of the Earth; this explanation has been rejected and ignored ever since it was recognized that valleys are shaped, and often originated by causes acting on the surface of the Earth, but it contained an element of truth, inasmuch as it recognized that the course of a valley may be determined by causes acting from within. Leaving this explanation on one side, we have firstly the views of the late Mr. H. B. Medlicott, who was the first to establish, by actual observation, the fact that a river may be able, by cutting down its channel, to preserve its course across a rising range of hills. He applied this principle to the great river-valleys of the Himalayas,

* 'Die Täler des nordwestlichen Himalaya.' Beobachtungen und Studien von Dr. Karl Oestreick. *Petermanns Mitteilungen*, Ergänzungsheft 155. Gotha, 1906.

which he regarded as relics of an earlier drainage system of rivers flowing from north to south across the Himalayan area, these rivers having cut down their valleys through the rising range, and continued to drain more or less of the country to the north of the main axis of elevation. The longitudinal valleys of the upper Indus and Sanpo were attributed to cutting back of the valleys of tributaries of these rivers along the strike of more easily removed rocks, whereby the transverse river-valleys were robbed of more or less of their upper waters.

As the interior of the range became better known, it was found that everywhere along the watershed there seemed to be evidence of its northward recession, and of an encroachment of the southern drainage area on the northern. This led to the promulgation of a fresh explanation, according to which the valleys of the upper Indus and Brahmaputra are structural, formed along a band of lesser upheaval, whose drainage escaped round the ends of the rising range in rivers which were able to preserve their course across the rising range in consequence of the volume of flow, resulting from the extent of their upper waters. Between these two cross-valleys the primitive watershed was regarded as having been practically coincident with the line of maximum upheaval, which again is that of the existing highest peaks; as the range grew in height, the difference in rainfall on its southern and northern slopes became more marked, the volume of the southward-flowing streams increased while that of the northward-flowing ones diminished, and the former began to cut back, till in some cases they were able to penetrate the main range and invade the territory previously occupied by the latter.

Our present knowledge of the interior of the Himalayas is not sufficient to enable us to balance these opposing explanations against each other, or to decide how far each has been the prevailing cause, yet some facts are known which suggest rather than establish the prevalence of one or the other. So far as the valleys of the upper Indus and Sanpo are concerned, we have the capital fact that the valleys of several of their principal tributaries join the main valley at an acute angle directed up-stream. This does not necessarily imply, though it very probably indicates, that these tributaries originally belonged to a different drainage system, and have been added to that which they now belong to by capture, that is to say, it is at first sight evidence of the truth of Mr. Medlicott's explanation. It does not, however, exclude the alternative one, for a large part of the area now occupied by the Himalayas must have been dry land at the time when they first began to rise as a mountain range, and this dry land must have possessed a drainage system, probably different from the existing one. The immediate cause of the alteration of this drainage into the two longitudinal valleys of the upper Indus and the Sanpo may have been cutting back and capture of the headwaters of other streams, the cutting back being in part controlled and directed by the occurrence of bands of easily removed rock, but it

may well have been directed and determined, in even larger degree, by the upheaval of the Himalayan range, which would raise a barrier across any rivers flowing from north to south, diminish their power of lowering their channels, and possibly, as has recently been suggested by Colonel Burrard, lead to their being dammed up and finding a fresh outlet to one side instead of along their original course. If this be the case, the longitudinal valleys would be as truly structural as if they had been originally determined by unequal movements of upheaval at the time when the Himalayan region first rose from the sea.

As regards the other rivers which traverse the main range, Dr. Oestreich rejects the explanation that the feature is due to cutting back through the original watershed; but his arguments, based on his observations in the Sind valley, do not seem valid. He calculates that if the levels of the outlets of the Sind and Suru rivers, into the Kashmir and Indus valley respectively, remain unaltered, the recession of the watershed cannot extend beyond some 12 miles or so from its present position, and, believing that the amount of recession which has taken place is only a mile or two, comes to the conclusion that the watershed must have remained, and will remain, pretty constant in its position. To this we may reply, firstly, that the assumptions cannot be granted, and, secondly, that if they were, the argument would prove nothing; of countless horses foaled each year, it would be easy to prove that any one could not possibly win the Derby, yet every year the race is run and won. The simile is, in fact, an apt one, for of all the foals born only a small proportion are ever entered for the race, a still smaller proportion reach the starting-post, and only one each year is added to the list of winners; and similarly on the south side of the Himalayas are countless valleys which have never had a chance of reaching the central range, a few have had the chance, but been distanced by their competitors, and still fewer have succeeded in reaching and penetrating the main range. The Sind river is probably one of those which has been outdistanced in the race, and will never have a chance of cutting back through the range of highest peaks to the valley of the upper Indus, but it does not follow that other and greater rivers, such as the Sutlej or the Kosi, have not been able to do so.

Leaving on one side, then, all arguments of an abstract nature, and coming to the consideration of the evidence there is for or against the explanation as applied to the valleys of the larger Himalayan rivers, we have, firstly, the fact that they traverse the main range in deep-cut narrow gorges, where the rivers are pent in narrow rocky channels. This suggests, though it does not prove, that the rivers have undergone a recent increase of volume, which may reasonably be explained by an increase in the area drained by their headwaters; and this, added to the evidence of recent recession of the actual watershed, suggests that the gorges are not relics of an older drainage, but due

to cutting back and capture, consequent on the steeper slope and heavier rainfall on the southern side of the range. The suggestion is strengthened by the fact that the feature to be explained is practically confined to the eastern half of the range, where the rainfall on the southern slopes is both actually and proportionately much greater than on the northern; here the headwaters of the southward-flowing rivers drain large areas to the north of the main line of snowy peaks, while west of the Sutlej, where the rain and snowfall become less unequally divided between the two sides of the main range, the watershed of the Indus drainage practically coincides with the main orographic axis of a line of highest peaks.

There remains one other point for consideration. It has been assumed, by all who have treated this problem in the past, that the original drainage of the Himalayan area was, as at present, from north to south; but there is no direct evidence that such was the case, and what indications we have point rather to the opposite conclusion. To the south of the Gangetic plain the peninsula of India is a fragment of a very old land surface; to the north of the Himalayas is an area which was sea through long geological periods; and when this sea was converted into dry land by the uplift of its bottom, the original drainage of the new land would naturally, though not necessarily, be from south to north and not in the reverse direction. If, as seems possible, this drainage still persisted when the elevation of the Himalayas began, it is evident that no part of the existing drainage system can be either "antecedent" or "superimposed," but all must be "subsequent," and the origin of the cross-valleys, of those rivers which rise to the north of the main lines of snowy peaks, must be looked for in the cutting back of their headwaters from the steeper and wetter side of the range. Certainly there are peculiarities in the courses of the Indus and Brahmaputra rivers, especially the very sharp angle at which they turn southward to cross the range, suggesting that this, after all, is the true explanation, and that the whole of the Himalayan area, which now drains to the Indian ocean and the Bay of Bengal, once drained off along channels whose courses are unknown, and have probably been obliterated by the great earth-movements of late tertiary and post-tertiary times.

Such is the present position of the problem. Nothing can be certain till the topography and the geology of the Himalayan region is better known, but if there is no certainty of the process by which the Himalayan drainage has been elaborated, it seems certain that it is due to a modification of an older and different drainage system. It is too soon to attempt to trace either the course of this earlier drainage or the history of its replacement by the existing valleys, but it seems clear that two factors have been important: firstly, the great differences in uplift of different parts of the range, and, secondly, the great difference

in the rainfall on its opposite sides. The relative importance of these two factors must have varied from time to time, and from place to place, detailed observations and study alone can decide which has been more important in each case, and the conclusions drawn from the study of one valley can hardly be applied to another, still less extended to a different and distant part of the range.

MR. CECIL CLEMENTI'S JOURNEY ACROSS SOUTHERN CHINA.*

An interesting journey across Southern China from east to west, in part by routes never before followed by a European, was made during the last three months of 1906 by Mr. Cecil Clementi, who carried out a route survey of most of the country traversed. This work was done with a prismatic compass, observations for latitude and time being also taken with a theodolite, while an aneroid was used for measurement of heights. The survey was plotted on the scale of one inch to the mile, covering three strips of tracing-paper with a total length of 15 yards. From these the map at the end of the present number has been constructed by the Society's draughtsman.

It will be seen that the route chosen by Mr. Clementi was of great interest, the middle part of it leading through one of the least known tracts of Southern China. The survey was begun at Hsün-chou-fu, at the confluence of the two main branches of the Si-chiang or West river, known respectively at the junction as the Pai Hoa or "North river," and the Yu-chiang or "Right river."† It was the latter which was followed by Mr. A. R. Colquhoun during his journey of 1882, and subsequently by a section of the French commercial mission to China sent out by the Lyons Chamber of Commerce under M. Brenier. The northern branch is in turn formed of two main components, the Hong-shue or "Red water" from the west, and the river of Liu-chou-fu—thought by M. Brenier to be the most important head-stream of the Si-chiang in point of volume—from the north. Its name, as given by Mr. Clementi, is Ching-shue ("Blue water"). This last river was traced by another section of the Lyonese mission, and also about the same time by Mr. Consul Bourne, in the journey undertaken on behalf of the Blackburn Chamber of Commerce. More recently it was ascended as far as Liu-chou-fu by M. François (cf. *Journal*, vol. 23, p. 518). Mr. Clementi ascended the North river to the junction of the upper branches, and then went overland to Lui-chou Fu, his further route

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* Map, p. 584.

† The name Hong-shue or Hong-shwei has usually been given to the northern branch, being the name of the arm which comes from the greatest distance.

taking him, in a generally west direction, past Ching-yuan Fu and various other towns, few of them marked in ordinary maps, to Yün-nan Fu. At Ching-yuan Fu he crossed the route followed in a north-south direction by Mr. Consul Bourne in 1886; but apart from this, the route as far as Ssŭ-chăng Fu was entirely new ground. Beyond the latter place little has been known of the route as far as Hsi-lung Chou, though it has been traversed by French missionaries. The last section, from Hsi-lung Chou to Yün-nan Fu, had been followed by a section of the French Commercial Mission above alluded to.

In the letters accompanying his survey sheets, Mr. Clementi says nothing as to the nature of the country traversed, or the general and commercial relations of its inhabitants—points upon which further information would be welcome. His original map gives, however, rough indications of the general character of the ground on either side of the route, and these have been reproduced in our map, so far as the scale permits.

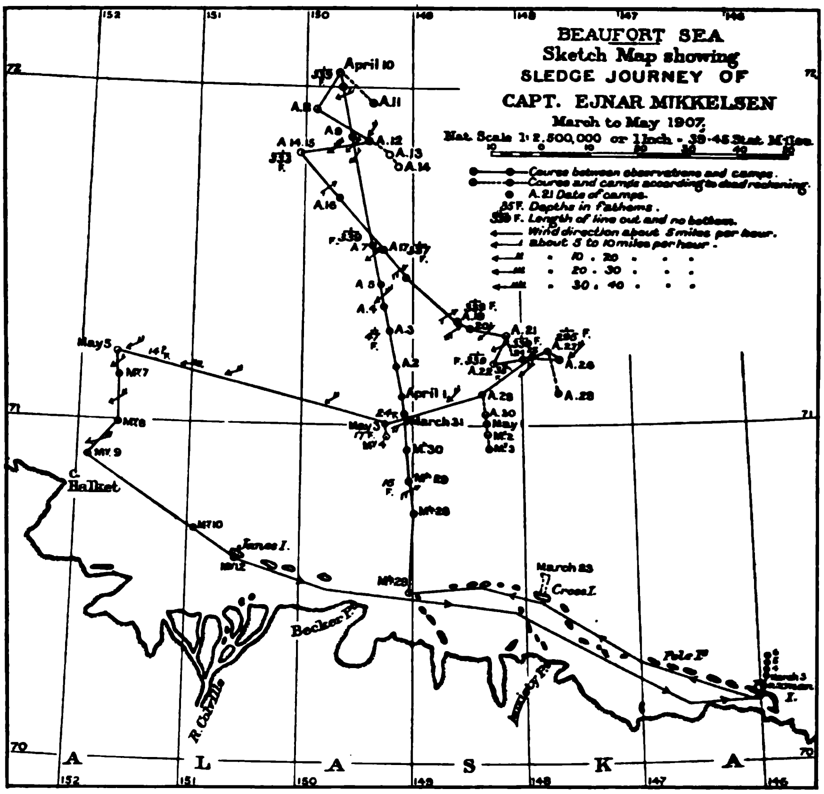
MR. MIKKELSEN'S ICE-EXPEDITION IN THE BEAUFORT SEA.

WE have received from Mr. Mikkelsen, by mail, a full report on his this year's work in the region of the Beaufort sea, and especially of the sledge expedition over the ice, made by himself and two companions during the spring months. It shows that, while no sensational work has been attempted, some valuable results, from a scientific point of view, have been gained by the patient collection of facts and observations which will considerably extend our knowledge of the physical conditions of the area in question. At the same time, the experience gained during the execution of the preliminary task—itself beset with no small difficulties and dangers—should prove of great assistance for the more serious undertaking to be attempted next year. Mr. Mikkelsen's narrative enters into copious details as to the nature of the ice, the direction and force of the winds and currents, and similar matters, all of which it is unnecessary to reproduce here.

Besides describing the sledge journey, the narrative clears up the obscurities which had existed as regards the loss of the *Duchess of Bedford*. The vessel sprung a leak on January 27, apparently, Mr. Mikkelsen says, through the forcing out of the caulking when the ice contracted, for the ship was in a perfectly land-locked sea, with no motion of the ice. The pumps were kept going incessantly, but this merely availed to keep the ship afloat during the building of a house on the shore and the transport of the stores to it, at which work help was obtained from the Eskimo, who were numerous on Flaxman island at the time. On April 11 the crew moved ashore, the ship then rapidly filling with water, which froze in the hold. After the return from the

sledge journey, Mr. Mikkelsen decided to break up the hull in order to get more building material, there being no possibility of doing any repairs.

A first start for the sledge journey was made on March 3. The land-floe formed the previous autumn had been constantly broken up by westerly gales, and at this time consisted of fields of young ice, with some heavy pressure ridges. Open leads frequently stopped the party, and after a time the ice became so heavy that it proved necessary to



return, the sledges breaking down through being too heavily loaded for such rough ice. A second start, with somewhat lighter equipment, was made on March 17, Mr. Mikkelsen being accompanied by Messrs. Leffingwell and Storkersen. Food was taken to last for sixty-five days from the final start seawards, besides a week's supply to be cached for the return. Bad weather prevailed for a time, and, the ice to the north showing no improvement, it was found necessary to keep a westward course to about 142° W. before striking north, which was done on March 28. The conditions were now more favourable, large fields of

young and level ice being met with, apparently due to a recent retreat of the pack from the shore and the freezing over of the intervening space. Presently, however, the ice became worse, consisting of heavy

FIG. 1.—PALÆOCRYSTIC ICE-FLOE.

FIG. 2.—HEAVY RUBBLE ICE.

floes of the preceding year, with pressure ridges, and lanes covered with thin ice. Soft, deep snow also caused much trouble. The further the travellers advanced, the greater was the quantity of old floe-ice encountered, and this afforded fairly good going (Fig. 1). Mr. Mikkelsen

terms it "palæocrystic," though recognizing that it differs from that which has previously been known by this name. The floes have rounded hummocks, and are perfectly covered with snow of a yellowish tint. The ice is quite fresh, and when fractured show the same blue colour as is seen in glacier ice.

In order to make a road the pickaxes were kept in constant use, and without them progress would have been impossible. As it was, the sledges suffered severely, and Mr. Mikkelsen found that a mistake had been made in not fitting them with steel-shod runners, the German silver employed proving quite insufficient for the heavy work required of it. On April 3, at about 43 miles from land, rough ice of the character that had stopped the advance further east was encountered, but it fortunately did not extend very far (Fig. 2). A sounding here gave no bottom at 86 metres (47 fathoms), the depths previously obtained being 30 and 44 metres respectively (16 and 24 fathoms). The sounding machine had not yet been rigged up, and when this was done, a sounding on April 7 gave no bottom at 620 metres (339 fathoms). Subsequent soundings, up to 32 miles further north, gave no different result, and the chances that the unexpectedly great depths were due to the presence of a submarine valley were thereby much lessened. Mr. Mikkelsen therefore feels confident that the edge of the continental shelf (which, it may be noted, is considered to occur on an average at a depth of about 100 fathoms) had really been passed.

On April 9 a longitude was taken, which showed that, instead of being east of the starting-point, as had been supposed from the dead-reckoning, the party were 20 miles to the west of that point, this being due to drift, which had evidently set in a northerly direction as well. The larger bodies of old ice (Fig. 3) were often bordered, on the west, by stretches of thin ice, and in crossing one of these pressure commenced, lanes opening up while the explorers were in the middle of it. On April 10 a great number of cracks (Fig. 4), some very wide, were encountered, and the explorers resolved to turn back, travelling south-east until soundings should be reached, and then following the edge of the shelf as far east as possible. But in spite of all attempts to make easting, observation constantly proved that the drift had taken them to the west instead, sometimes even against the wind. They continued to take soundings, but even with 70 metres of spare line added to the 620-metre wire, no bottom could be reached, although 44 metres had been obtained in a latitude only 16 miles further south. At last, on April 22, a sounding of 63 metres (34 fathoms) was obtained, and a north-and-south line was run to determine the slope as exactly as possible. From 88 metres (48 fathoms) there was a drop to 220 metres (120 fathoms) in three-quarters of a mile, while the last sounding (with bottom) of 519 metres (284 fathoms) occurred only $2\frac{1}{4}$ miles from the starting-point. Landwards, progress was stopped

at the end of a mile by a wide crack, the depth being here 50 metres (27 fathoms). The lead was unfortunately lost in taking this last sounding, but for a time the small pickaxe was used, until this too was

FIG. 3.—PALÆOCRYSTIC ICE-FLOE.

FIG. 4.—CREVASSE IN PALÆOCRYSTIC ICE.

lost—a serious misfortune, as the larger one had previously been dropped through a thin sheet of ice. Next morning a strong set to the west-north-west was apparent (with a wind from east-south-east), and a

new sounding through the hole where 88 metres had been obtained, gave a depth of 171 metres. On April 26 the thermometer stood for the first time above freezing, and the going was bad. The raft was used for the first time to ferry the party across a lane 100 yards wide. It was made by lashing two sledges together with poles and covering the frame so formed with a piece of canvas, and it could carry a sledge loaded to a total weight of 320 lbs., with a man to pull it across. It was used without mishap, and as the extra weight carried for this purpose was only 22 lbs. (including 14 lbs. for the canvas, also used as a tent cover), the device certainly seems to have proved a success.

The frequent ridges, together with heavy rubble covered with deep, soft snow (Fig. 6), now made the going worse, but a more serious hindrance was caused by the numerous lanes covered by ice too thin to walk over. Relative motion of the ice was also perceptible. With a stronger drift to the west than could be overcome by walking east, there was nothing for it but to make for the land, which proved more difficult than had been expected. It was sometimes necessary to cross the cracks upon the small ice and slush which filled them, and disaster was often narrowly escaped. A dark-water sky showed itself all round, and on reaching the edge of the pack, a stretch of perfectly open water separated the travellers from the land-floe. While waiting for the crack to close up, the piece of ice on which they were camped broke off and floated over. Abundant animal life was seen in and about the crack, including a bear, ducks, seagulls, and seals—the last of which were seen whenever there was open water. Many tracks of foxes were seen, especially at about 50 to 70 miles from the land. Crossing the land-floe, the lagoon-ice was struck on May 9, and by following the mainland or the sandspits, the party reached camp on May 15. The trip, which lasted 60 days, had covered in all 533 nautical miles.

Besides the soundings already mentioned, the journey had determined the fact that at this time of year there is a strong drift to the west with an easterly wind, but little or none to the east with a westerly one. In summer, when the ice is more free to move, and when easterly winds prevail, the westerly drift would naturally be considerably greater. Yet the experience of explorers and whalers shows that plenty of ice is met with during the summer along a great part of the coast. The exceptional character of the old floe-ice encountered by Mr. Mikkelsen (which he thinks older than any seen by him on the east coast of Greenland) would seem to indicate that there is no unobstructed road to the westward, but that this ice is formed in a land-locked sea. The absence of drift to the east, even with a westerly wind, would seem to argue an obstruction to the eastward, yet if the continental shelf is as narrow as seems to be indicated, there would be little room for it in this direction. Mr. Mikkelsen thinks that the land reported as lying north of Point Barrow and Harrison

bay is probably old heavy ice, which, seen in a certain light, conveys the idea of distant land, the Eskimo accounts of rounded hills on the supposed land strengthening this idea.

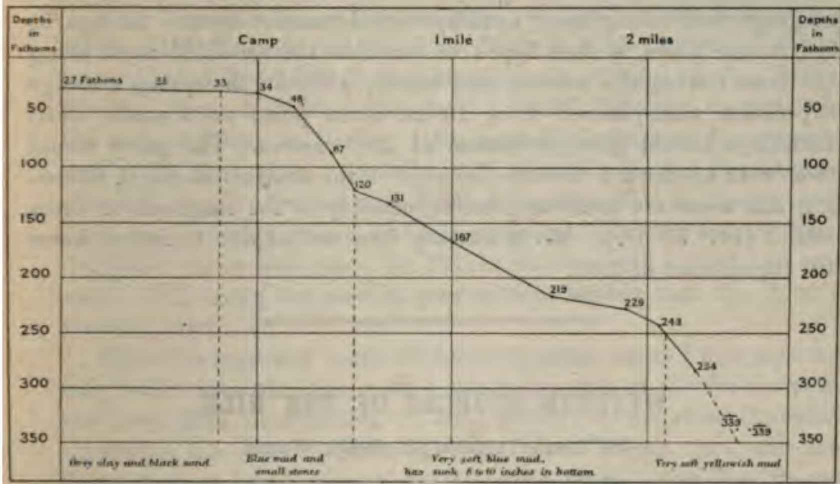


FIG. 5.—SOUNDINGS TAKEN OVER THE EDGE OF THE CONTINENTAL SHELF, APRIL 22, 1907. STATION AT CAMP, LAT. 71° 12′ N., LONG. 148° 24′ W.

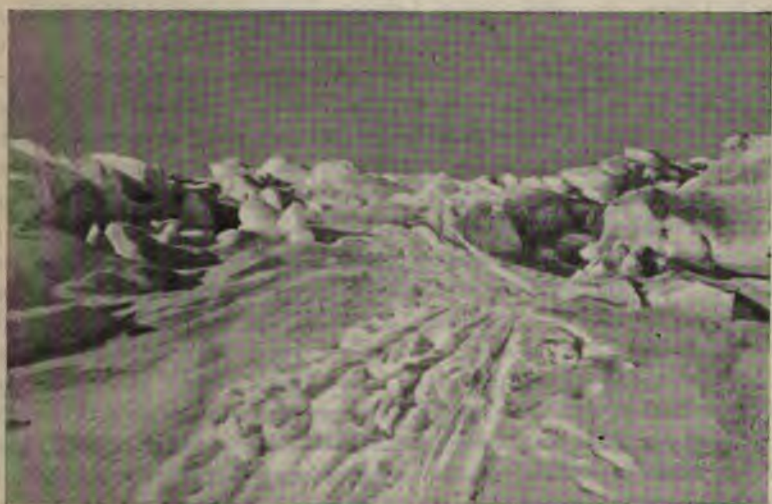


FIG. 6.—HEAVY RUBBLE AND DEEP, SOFT SNOW.

The result of the year's work include hourly tidal observations at the camp from the early autumn to January 1, and for three days at Icy reef and Pole island. Meteorological observations have been kept up without interruption, while Mr. Leffinwell has determined several

positions astronomically, and has corrected the map of the coast from Flaxman island to Herschel island, besides undertaking surveys and geological work inland. Mr. Stefansson, after failing to find the ship at Herschel island, travelled about with the Eskimo, learning their language, and taking many anthropological measurements. As regards the future plans, it was hoped to continue the scientific work along the coast during the autumn and winter, while for the spring a sledge expedition was planned from Demarcation point northwards, until soundings should give no bottom at 1200 metres. The party would then work southward towards the edge of the continental shelf, following this westward as far as possible, possibly to the longitude of Cross island (147° 50′ W.). Mr. Mikkelsen does not expect to return home till the autumn of 1909.

WESTERN SOURCES OF THE NILE.

By Lieut. D. COMYN, Black Watch.

THE hydrography of the Nile and its tributaries has, from the earliest times, been of interest. Hence I venture, as one with the authority of a Didymus, to attempt to throw some light on what I see is even now in intense obscurity. Such, however, is the variety in the nomenclature of a single river, that the reader must be prepared for it. To one uninitiated it would appear as though he were running the description of several countries into one another, such a wealth of rivers being impossible in one. For instance, one of the two main streams of which I am about to write has three distinct names. It has others, but the people, through whose country it flows, are generally agreed on calling it the "Boru" from its source to somewhere near Jebel Talgona; "Telgona" to the Dinka country; and the "Lol" from there to its junction with the Kir river. Once a guide was able to tell me of fourteen names for one mountain. And it has frequently happened that, when travelling on a road I had previously mapped, I found the names of the various features given to me by the second guide entirely different from those given me by the first—the reason being that each tribe (and they are numerous), I might almost say each village, has its own name for them. As, however, this is generally the case in all really savage countries, I need not enlarge on the subject.

The mouth of the Bahr el Arab, the river itself for the short way near it, and likewise part of its tributary the Lol, have been explored by Captain Percival, D.S.O., and Lieut. Bayldon, R.N. Their explorations, combined with information drawn from the maps of the old explorers, have, however, led authorities into the mistake, I should add the very natural mistake, of thinking that three waterways of importance are

to be found flowing east from the hills of our western frontier, whereas there are but two. The above-named officers determined positions, as I have already said, at and near the mouth of the rivers in question, and I nearer their sources.

Khor Dabura is the only watercourse with any pretence to importance between the Telgona river and the Bahr el Arab (known at this the eastern point I crossed it (Sheikh Shenoa's village) as the Bahr el Rizeigat), beyond which is five days' "atash" (drought) to Abu Gabra, the wells of Shaka, in Darfur. It is a small watercourse flowing south-east to the Boru river. Its only claim to notice is that it contains an abundant supply of water some 8 feet from the surface in the dry season. This, in a country where water is comparatively very scarce, was no doubt the reason that made Dr. Felkin mark it with a thick line on his map. This being the case, it goes without saying that the third big river is a myth.

Since the regretted death of Colonel Sparkes, C.M.G., I find myself the only white man who has crossed the headwaters of all the rivers from the river Wau, in about lat. 6°, long. 26° 30′, to the river Umbelacha, otherwise the Bahr el Arab, in about lat. 10°, long. 24°; and lower down again on each, more than 100 miles, as the crow flies, from the first point of crossing.

In the first place it is of interest to tabulate the rivers and their important tributaries with which I have to deal—

	Tributaries.
River Jur, or Sueh	River Wau or Buseiri
River Boru (other names Telgona and Lol) — ...	Pongo or Ji Kuru or Chell (Tyell) Sopo Raga Dabura
River Umbelacha (other names, Bahr el Arab, specifying some tribe on its banks, *e.g.* Bahr-el-Rizeigat, -el Homr, and Kir)	Barada or Obo Vongo Reikei Yofo Serri (sandy) Sheileika (sandy) Kavaduka Janverindi (sandy) Gotelo

The tributaries of the Boro (Telgona or Lol) appear to me worthy of description. The main river seems to be the chief waterway of the west. Not only do they contain water all the year round, and further are themselves, for the most part, not low-banked channels of sand, as those of the Bahr el Arab, but noble rivers, for a good portion of the year undoubtedly navigable by shallow-draught steamers of a small type already known in the Sudan. There being no sudd in them, the question of screw or stern wheel need not be considered. (The sudd-cutting party at the mouth of the river Kir has not yet finished cutting a channel there (1906).)

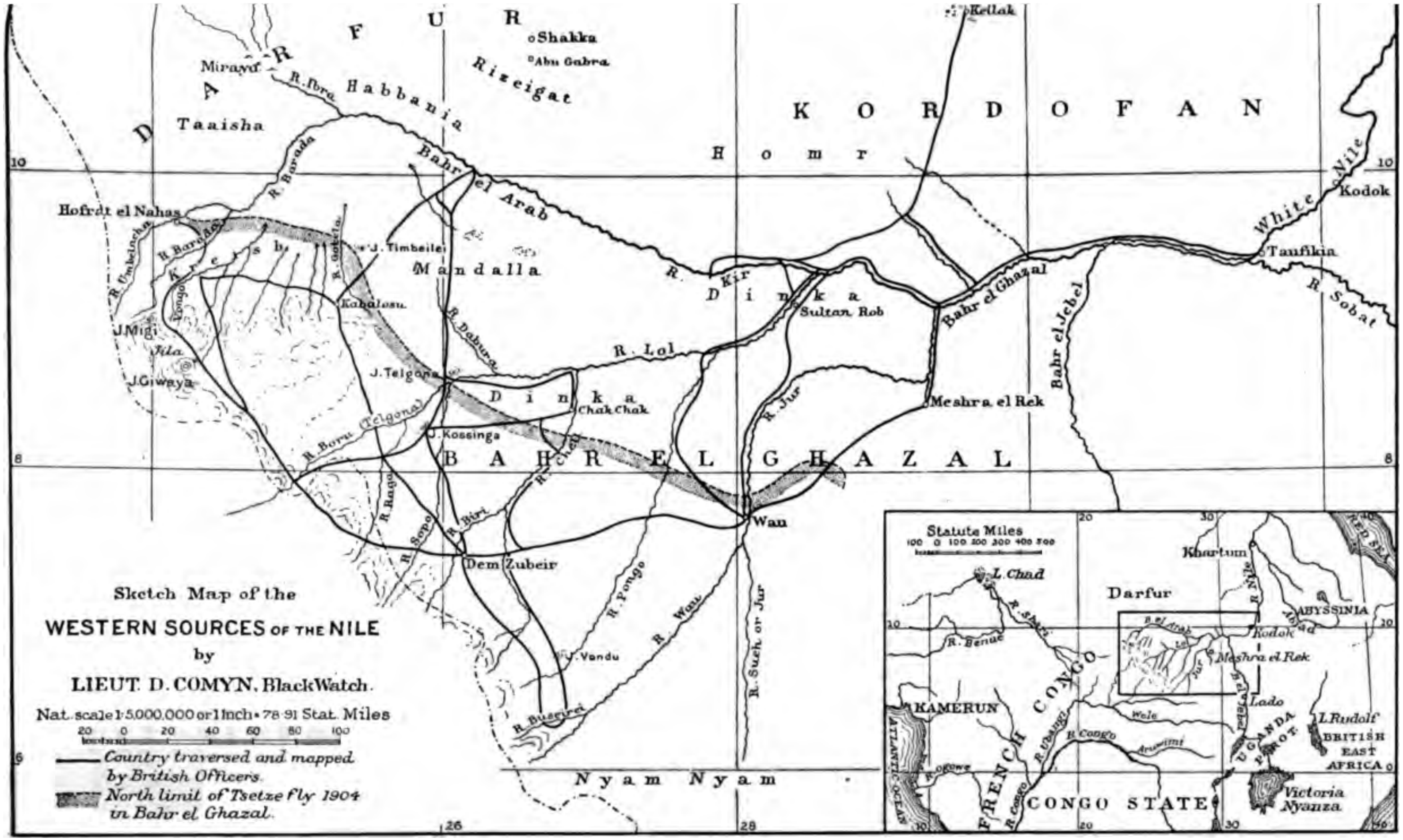
The country in which these rivers take their sources is more undulating than hilly. Unlike the country round the source of the Bahr el Arab, a hill is here a remarkable feature.

A hundred miles south of the well-known station Dem Zubeir is the Buseiri. It is one of the five tributaries which, when joined together, form what is known as the river Wau. I crossed this river at two points a few miles apart, and of course saw its junction with the river Jur near the military station Wau, the Fort Desaix of the French cartographers. At the western point I found the river about 20 yards across, banks about 20 feet high, flowing in a sandy bed through what, in the rainy season, would be a swamp about half a mile across on both sides. This swamp may be due to the junction of several big khors at this place. The western khor was a broad and shallow depression, the others almost rivers—small ones—which at that time, the height of the dry season, still boasted a trickle of water. Further north I had found sources of these khors to be water-holes connected by swamp with a steady flow of water between them. Following their course I occasionally noticed all signs of flow and swamp disappear; then I crossed a rise of ground, and the continuation of, as far as I could judge, the same streams cropped up again. The character of the Buseiri changed very soon. Big trees lining the banks, it ran between small steep hills, the foot of which formed them. There it was still as wide and with banks as high as before, though the bottom was rather rocky.

I crossed the Pongo, there known as the Ji, at a point some 10 miles south of Jebel Yandu. I marched down a marshy depression in the centre of which was a "gallery wood," and came upon the river, there a babbling brook with a stony bed about 12 feet wide, banks about 6 feet high. Trees interlaced themselves over the water. On my return march, 20 miles more to the east, I found the river at the bottom of a well-marked valley. There it was as broad and of the same character as the river Buseiri. On the road from Wau to Dem Zubeir one crosses the same river. It is there a fine stream over 40 yards across, with a sandy bed, the country on both banks being rather flat. Captain Percival, D.S.O., followed up this river from the Wau-Dem Zubeir road to its junction with the river Lol.

The next important stream is the Kuru, which, from the junction of its fine tributary the Biri, is known to the Dinkas, through whose country it passes, as the Chell. I crossed the Kuru, which I have followed to its junction with the Telgona or Lol, about 60 miles south of Dem Zubeir (about long. 26° and lat. 7°), and even there it was a fine stream receiving many large khors to swell its volume. Up to its junction with the Biri it flows on a rocky bed through high undulating country.

At one point I stood on a very steep hill immediately above the river, which meandered through thick forest quite 200 feet below me, a



Sketch Map of the
WESTERN SOURCES OF THE NILE
by
LIEUT. D. COMYN, Black Watch.
Nat. scale 1:5,000,000 or 1 inch = 78·91 Stat. Miles
Country traversed and mapped by British Officers.
North limit of Tsetze fly 1904 in Bahr el Ghazal.
DARFUR
KORDOFAN
BAHR EL GHAZAL
Homr
Dinka
Mandalla
Habbania
Rizeigat
Taaisha
Kreish
Nyam Nyam
Shakka
Abu Gabra
Mirayu
Kellak
Kodok
Taufikia
White Nile
R. Sobat
Bahr el Ghazal
Bahr el Jebel
Meshra el Rek
Sultan Rob
R. Kir
Bahr el Arab
R. Lol
R. Jur
Wau
R. Wau
R. Pongo
R. Such or Jur
Dem Zubeir
Chak Chak
J. Kossinga
J. Telgona
R. Telgona
R. Boru
R. Rago
R. Sopo
R. Biri
R. Chel
R. Dabura
Kabalosu
J. Timbeilei
R. Gotola
R. Barada
R. Ibra
Hofrat el Nahas
R. Umbelecha
J. Migi
Jila
J. Giwaya
R. Bussiri
J. Vandu
Statute Miles
L. Chad
R. Shari
R. Benue
KAMERUN
ATLANTIC OCEAN
R. Ogowe
FRENCH CONGO
R. Congo
R. Ubangi
Wele
Aruwimi
CONGO STATE
Darfur
Khartum
R. Nile
ABYSSINIA
RED SEA
Kodok
Meshra el Rek
Lado
UGANDA PROT.
L. Rudolf
BRITISH EAST AFRICA
Victoria Nyanza

unique experience in this country. After its junction with the Biri, also a rocky but not so important stream, it widens out to about 70 yards with a sandy bed. The country on both sides is much flatter than anywhere else west of long. 27°. In fact, it is strange how exceptionally flat it is between the Sopo and the Chell. The watershed of these rivers is almost imperceptible for 100 miles south of the Boru (Telgona river).

The next tributary that claims our attention is the Sopo. I have also followed its course from the point where it is a tiny brook to its junction with the Telgona or Lol, which latter, from this place to its source, takes the name of Boru, which, the natives inform me, means "stony," and it does not belie its name. The Sopo and the Raga, a parallel and still less important stream which joins the Boru some 60 miles further west than the former, are both very rocky, taking their rise near the Mongaiat, a most extraordinary mass of round smooth bare hills of solid stone.

We have now reached the Boru, Telgona or Lol. But few miles of its course have not been traversed as yet by British officers. I crossed this river at the foot of the hills in which it rises. There it flows between banks 20 feet high, in a rocky bed 20 yards wide, quite 300 miles west, as the crow flies, from the scene of Lieut. Bayldon's (R.N.) sudd operations at the mouth of the Bahr el Arab on the Bahr el Ghazal. I followed it on and off for the next 150 miles east of this point, to where the river Kuru or Chell flows into it, and 50 miles further east Captain Percival, D.S.O., crossed it, there called the Lol, and followed it to its junction with the Kir. The last 200 miles, as the crow flies, up to its junction with that river, it ceases to be rocky. No khor or river of any importance joins the left bank of the Lol till we come to the Kir, or Bahr el Arab, with the exception of Khor Dabura, which flows into it somewhere near its junction with the Chell; and still further west several deep khors, none of which, however, deserves mention.

The hills of the frontier, and right high ones for this country, throw out what might be called a peninsula (starting between about lat. 8° 30′ to 9° to long. 25°), and thus form the watershed between the affluent rich Boru and the equally poor Bahr el Arab. The Bahr el Arab starts life flowing in a northern direction for over 50 miles through hills, taking a sharp turn to the east in the vicinity of Hofrat el Nahas, where it is a fine river, 100 yards broad, the bed being sandy, with huge smooth reefs of rock crossing it at intervals; the banks are about 15 feet high. This means that a number of mountain torrents flow westward to it, which explains its size so early in its course. These torrents are not of great importance save the river Barada (or Obo), wrongly called the Bahr (river) Ada, which is the smaller of the sister streams that meet about 100 miles from their source, and form the mightier and celebrated

river. It might be added that, from native information, it appears that near this point of junction the river commences to flow through "butas," *i.e.* swamps that are quite dry and covered with fine grazing for the better part of the year, and with water some feet deep during the river flood.

Of those that flow northward to join it after it has taken its turn, the most important, crossed by me from the east, is the river Gotelo, a perennial stream, in which was a flow of water when I crossed near Kabalosu—not far from Jebel Timbeilei (marked on Felkin's map). The bed of this stream is peculiar, the only one of its kind I have seen in this country—viz. very sharp knife-like edges jutting out from both sides of the river-banks. I was told that this stream always, even in the worst years, contains flowing water; I understand the only one that does in these parts. Certainly when I crossed it—it was a dry time, very dry—there was a very perceptible flow of water from pool to pool.

Others are most peculiar; *e.g.* the river Sheleika consists of a dry channel of deep sand 80 yards broad with very low banks. There were some pools of water in most, but some were quite dry. Then, further west, we come to the Reikei and the Vongo, both fine rivers, though small—the former rising where the road passes Jebel Giyawa (or Jila, the name of the district at its foot), and being a fine stream on the Kabalosu road, about 50 miles further north-east; the latter, running parallel to the river Barada, rises near Jebel Migi, and, but for the amount of water it holds, would be little more than a khor.

Standing on the summit of Jebel Migi, about long. 24°, lat. 9°, I was shown the hill, about 100 miles away, near which the Bahr el Arab rises—its "Ras el moya." As the "Umbelacha" to the Kreish (a tribe of those parts), it runs till it is joined by the Ibra, the outlet of the "Miraya," a sort of swamp which, I am told, takes in the flow of a number of wadis, which form the water system of Darfur to El Fasher and beyond. This is, however, hearsay. From that point the sandy bed disappears (this I have heard from the Kreish and Arabs), and the river, taking the names of the various Arab tribes who graze their flocks on its "butas" when sufficiently dry, becomes what I found it to be about 150 miles in a straight line from Hofra en Nahas. A long and waterless march had brought me to this point, Sheikh Shenoa's "village." There I found the river to consist of a mud channel 20 yards broad and 20 feet deep, with trees dotted along its banks, flowing in the centre of a vast plain some miles across. This, I was told—indeed the evidence of my senses would have done that had I been alone—is overflowed to the depth of 4 feet or so when the river is in the full flood, which rises and falls very rapidly.

I had not been many minutes there before I was surrounded by a number of Rizeigat sheikhs and Arab merchants. They all told me, as did men of my escort who knew the country, that the river was known

at various points by the name of the tribe which grazed its flocks on its banks—all Arabs—till finally it entered the Dinka country, and changed its name from Bahr el Homr to Kir. Also that there was, north of where we were, an almost waterless stretch of country to Abu Gabra (the wells of Shaka). (When I myself was at the junction of the Chell and Lol, the Dinkas told me that a short distance to the north was the big Arab river.) A hundred and fifty miles or so further east, Captain Percival, D.S.O., crossed it, and followed it to where the Kir and Lol become one.

It has been suggested that the river that flows by Hofra en Nahas is not the Kir; but unless the latter is the Khor Dabura, which is denied by the natives, and which is so insignificant 100 miles from the junction of the Kir and Lol to render it, flowing as it does in a flat country, a miracle of growth, were it to become what the Kir is reported to be, which would be physical impossibility, the tenet cannot be maintained, so I fail to see where a third river can be fitted in. Nor is the Kir and Gotelo one. The remarks applied to the Dabura apply equally to the Gotelo.

From the river Wau to the Bahr el Arab, every stream except the Pongo, from the immediate vicinity of its source to its junction with a greater river, has been followed by myself. I except unimportant tributaries of the Bahr el Arab, whose courses ran within the triangle of my marches. Along the watershed I have crossed the headwaters of all streams from the Wau to the Bahr el Arab (Umbelacha). And again, from the Bahr el Rizeigat to the Boru, I have found no stream to cross: all those, on another line I had traversed, flowing west. Hence I do not think that there can be any doubt remaining as to the water system of the western sources of the Nile.

The inviolability of frontiers has prevented me going to Shaka, neither would my duties have brought me there at the time, but the road to that place is as well known and almost as well beaten as the Grand Trunk road of India.

A glimpse at the attached map, showing the actual routes traversed by British officers (in so far as they affect this subject), and the flow of any streams, will, I fancy, render my attempted exposition clearer.

It must be remembered that, when talking of a "fine" river, the term might be misunderstood. I mean thereby a stream in which, in the dry season, one finds a large pool of water every few hundred yards, and which, in the wet season, brings down a large, deep flow of water.

THE RÔLE OF ALGAL GROWTH IN THE COLONIZATION OF NEW GROUND AND IN THE DETERMINATION OF SCENERY.

By F. E. FRITSCH, D.Sc., Ph.D., F.L.S., Assistant Professor of Botany, University of London, University College.

THE study of plant-ecology, *i.e.* of the relation between plant and habitat, between a piece of vegetation and the prevalent conditions in the area in which it is developed, is making rapid strides at the present day, and, as our knowledge in this respect increases, we are beginning to inquire more carefully into the methods of colonization of new ground by plants. The study is an important one, not only in its scientific aspects, but also from the economic and geographical point of view, and a brief consideration of some of the early stages in colonization may not be without interest.

In many cases new ground may from the very first be in a suitable condition for the growth of higher plants (Vascular Cryptogams and Phanerogams), as, for instance, in the case of a dried river-bed,* or the alluvial deposit laid down in the lower stretches of a large river. Here the ground afforded for colonization is both finely divided and impregnated with a certain amount of organic substance (humus), so that a soil is present at the outset. In other cases, however, the ground is not ready for immediate colonization, either requiring disintegration for the production of soil or formation of a certain amount of humus to render the soil fertile, and to enable it to retain a sufficient amount of water. Disintegration is, of course, always a primary necessity before any higher vegetation can make its appearance on a bare rock-surface, whilst frequently the formation of a certain quantity of humus is obligatory for the development of anything more than a very meagre growth of plants.

Not at all uncommonly various terrestrial or semi-aquatic Algæ play a very important part in preparing the way for higher forms of plants, serving either both as disintegrators and humus-producers, or merely in the latter capacity. Their agency is by far the most evident in the tropics, although Algæ are commonly found to be active in much the same way (though not to so marked an extent) in our parts of the world. The observations I have to record are very incomplete, and I have no doubt that many more facts than I can produce will become evident in course of time. Since the essential phenomena are so much more obvious and more readily studied in the damp parts of the tropics, I may be excused if I commence my description by detailing certain observations made in Ceylon in the course of a study of its subaërial algal vegetation.†

It is, moreover, in the tropics that these subaërial Algæ often place a very decided stamp on the scenery of a district, a point which is well illustrated by Welwitsch's ‡ description of 'The Pedras Negras of Pungo Andongo in Angola.' These black

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* M. C. Stopes, "The Colonization of a Dried River-bed," *New Phytologist*, vol. 2, 1903, pp. 186–192; cf. also Scott Elliot, "The Geographical Functions of Certain Water-plants in Chili," *Geo. Jour.*, vol. 27, 1906, pp. 451 *et seq.*; V. P. Jaeger, "Jetzt und Einst. Eine pflanzengeographische Skizze," 52 Jahresber. d. fürsterzbischöfl. Gymnasiums am Coll. Borromaeum z. Salzburg, 1900–01 (Salzburg, 1901), pp. 1–48.

† Cf. also Fritsch, "A General Consideration of the Subaërial and Freshwater Algal Flora of Ceylon," Part i., *Proc. Roy. Soc. London*, Series B, vol. 79, 1907, p. 197 *et seq.* (Sect. *a* of this paper deals with the subaërial algal flora.)

‡ Welwitsch, in *Journ. of Travel and Nat. Hist.*, vol. 1, 1868; also 'Apontamentos Phyto-Geographicos solve a flora da provincia de Angola, etc.,' Annaes do Conselho Ultramarino, Parte não off. Ser. 1, Dez. 1858, p. 533.

rocks owe their colour to the abundant growth of a subaërial Alga (*Scytonema Myochrous* (Dillw.), Ag. var. *chorographicum*, W. and G. S. West), which "during the rainy season generates and multiplies so rapidly that the upper portions of the mountains are covered with it in a very short time. . . . Soon after the hot season has set in, at the end of May, when the horizon above the Presidium is generally clear and bright, the black plantlets begin to discolour with the intense heat. They gradually become dry and brittle, until they peel off altogether by-and-by, after which the rocks lose their sombre black aspect, and reappear in their natural grey or grey-brownish colour before the succeeding spring." I am not aware of any other definite record testifying to the abundance of subaërial algal growth in the tropics.* In the case of the subtropical Azores, however, Bohlin † describes the occurrence of four terrestrial Algæ (*Chroolepus aureus*, *Zygogonium ericetorum*, *Glœocapsa Magma*, *Stigonema minutum*), "vivant sur le sol nu . . . en très grand nombre."

I did not see anything quite as striking as the growth, described by Welwitsch, in Ceylon, but similar phenomena on a less extensive scale are abundant enough. If the damp regions of Ceylon were robbed of their subaërial Algæ, an important characteristic of local scenery would be lost. Every wall, rock, tree-trunk, etc., bears a more or less dense sombre covering of algal growth, and the drier localities in the island (*e.g.* Hambantota, Anuradhapoora) show us how different our surroundings look when the conditions (viz. insufficient moisture) do not admit of the development of such algal vegetation. On the other hand, wherever the rainfall becomes excessive (as at Labugama, with 166 inches), the subaërial Algæ form a thick covering on every conceivable object. The marked difference cannot fail to strike any one who is at all observant of his environment.

In our parts of the world we are accustomed to see exposed objects covered with a bright green powdery or filmy covering, which is due to green Algæ like *Pleurococcus* and *Hormidium*. In many cases this covering presents a yellowish-green colour, owing to an intermingling of fungal hyphæ with the Alga (an initial stage in Lichen-formation, cf. p. 543). We are so used to the presence of such a coating that the general influence it has in brightening up the scene is scarcely noticed, until we visit a neighbourhood in which for some reason or other it is not developed. But the algal growth found on similar substrata in the tropics is much more extensively developed, and consequently much more obvious, whilst a little careful study teaches us that it fulfils a much more important duty than it generally does in temperate regions, viz. that of preparing the ground for vegetation of a higher type.

The agency of algal growth in this respect has already been emphasized by Treub ‡ in describing the recolonization of Krakatoa after the eruption of 1886. He describes how members of the Cyanophyceæ (*Tolypothrix*, *Anabæna*, *Symploca*, and *Lyngbya*) are the first forms to put in an appearance. In his words: "Il s'est trouvé que les cendres et la pierre ponce composant le sol de Krakatau, sont presque partout couvertes d'une mince couche de Cyanophycées. . . . De beaucoup la plus fréquent est le *Lyngbya Verbeekiana*; ensuite vient le *Lyngbya minutissima*. . . . Grâce à ces six espèces d'algues et à leurs gaines vides . . . le sol aride de Krakatau est recouvert d'une mince couche gélatineuse et hygroscopique. . . . Les algues

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* See, however, Warburg, 'Ökologische Pflanzengeographie,' German edition (Berlin, 1896), p. 215; cf. also Fritsch, "The Subaërial and Freshwater Algal Flora of the Tropics," *Annals of Botany*, vol. 21, No. 82, April, 1907, p. 237 *et seq.* (in which all the data regarding extent and composition of tropical subaërial growth are considered).

† Bohlin, "Etude sur la Flore Algologique d'eau douce des Açores," *Bih. K. Sv. Vet.-Ak. Handl.*, vol. 27, Afd. III. No. 1, pp. 12, 13, 50, 51.

‡ Treub, "Notice sur la Nouvelle Flore de Krakatau," *Ann. Jard. bot. Buitenzorg*, vol. 7, 1888, p. 213; see also Penzig, *loc. cit.*, vol. 18, 1902, pp. 92 *et seq.*

préparent le terrain aux Fougères, en quelque sorte comme celles-ci le feront à leur tour aux Phanérogames." Observations of an analogous kind were made in Ceylon, and are dealt with below.

Apart from its exceptional luxuriance, which is especially noticeable in hot regions with a high rainfall, the subaërial algal growth of Ceylon, and probably that of the tropics generally,* differs from that of our parts in its composition. It is not, as a rule, bright green, but is dark in colour; it is by no means always developed as a powdery or filmy covering, but more commonly as a relatively thick tangled or tufted mass, forming a carpet-like coating on the substratum. The difference in colour is due to the fact that green Algæ are as good as wanting in the subaërial vegetation, which is composed almost entirely of a large number of different representatives of the so-called blue-green Algæ (Cyanophyceæ, Myxophyceæ). This group, which includes unicellular, colonial, and filamentous forms, is not quite unimportant even in our parts, some of the bright blue-green, and especially the dark blue-green coatings, frequently seen on rocks, pavements, etc., being due to members of this group. But the large majority of the Cyanophyceæ require a high temperature for successful growth, being, for instance, amongst the only plants which are found in the warmer waters of hot springs (Carlsbad, Yellowstone Park, Iceland, etc.). Nor is it difficult elsewhere to convince one's self that a high temperature is a primary necessity for the rich development of these algal forms; any damp hothouse furnishes abundant proof (*e.g.* the *Nepenthes*-house † in the Royal Botanic Gardens at Kew, in which a number of the photographs illustrating this paper were taken). The Cyanophyceæ show many peculiar characters (*e.g.* the curious cytology, the heterocysts, the hormogonia, etc.), which seem to be archaic, and there seems also good reason to believe that numerous forms of this or similar groups existed in past ages of the world's history, though of necessity the fossil records are rather meagre. This being so, we need not wonder at the excessive development of this group in the moist tropics, for there we have conditions which probably come nearest to those obtaining in the earlier epochs. Certain members of the group have, indeed, learnt to suit themselves to the lower temperature and smaller humidity of temperate regions, but the evident paucity of most of them, both in number of individuals and in extent of development, points to the prevalent conditions not being the most suitable. In the tropics, however, we see this group in its natural habitat, and it seems very probable that many dubious points about it will be settled by studies carried on in those regions.

High temperature and a damp atmosphere are no doubt essential for the development of the luxurious algal covering seen in many parts of the lowlands of Ceylon; but these two factors are not the only ones to account for the abundant growth of blue-green Algæ, and the practical lack of subaërial green forms. The absence of the latter is due to the operation of a third factor—the light. It is a familiar fact that the chlorophyll of plants gets decomposed by light above a certain degree of intensity, and there can be no doubt that in an exposed situation in the tropics the light is too intense for simple green forms without adequate arrangements for the protection of their chlorophyll. Indeed, even Mosses and Liverworts, which form a luxuriant vegetation on the tree-trunks in the shady jungles, etc., are very scarce in all exposed situations. The blue-green Algæ, however, are better equipped. In their

* See Fritsch, in *Annals of Botany*, April, 1907, p. 238 *et seq.* The observations of Welwitsch, Bohlin, and Treub quoted in the preceding paragraphs point to the great importance of blue-green forms in every case.

† Cf. Fritsch, Algæ, in "The Wild Fauna and Flora of the Royal Botanic Gardens, Kew," 'Bull. Misc. Inform. Roy. Bot. Gards., Kew,' Addit. Series V., 1906, pp. 187 *et seq.*

cells the chlorophyll is accompanied by a blue or otherwise coloured pigment (phycocyanin), the two being so closely intermingled that even high powers of the microscope do not admit of their distinction. The resulting colour is in all shades from bright blue to blue-green or almost black; brown is also no uncommon tint. The additional colouring-matter certainly acts as a screen to the chlorophyll in these Cyanophyceæ, and thus enables them to exist in the intense light of exposed tropical habitats, which is fatal to the existence of the lower green forms. It seems very probable that the diverse shades of pigmentation observed in the blue-green group may be connected with the diverse types of illumination in different habitats. The cells of the Cyanophyceæ are, moreover, generally provided with thick mucilaginous sheaths, which are often highly coloured, and then no doubt serve as a further screen to the chlorophyll. Before leaving the discussion of the part played by the light in determining the essential character of tropical subaërial algal growth, we may notice that there is only one genus of the green Algæ that occurs abundantly in the latter. This is a filamentous form—*Trentepohlia* (*Chroolepus*), species of which are not uncommon in temperate regions, especially in mountainous districts (where there is strong insolation). They are very common in Ceylon, however, and form bright orange-red tufts arising amidst the dark Cyanophyceous growth and constituting a frequently agreeable interruption to its monotony. There is abundant evidence to show that species of *Trentepohlia* also play a great part in other tropical regions.* The orange-red colour is no doubt the secret of the success of this form; † the cell-sap contains a yellowish-red oil (hæmatochrome), which forms a mask to the chlorophyll, and, like the phycocyanin in the blue-green cell, protects it from the harmful action of the light. The colour of one and the same species of *Trentepohlia* varies according to the habitat; in exposed positions it is deep orange-red, in protected localities almost pure green. The masking colouring-matter thus appears to be developed under the influence of intense light only. The species of *Trentepohlia* are a particularly striking feature on the trunks of the coconut trees in the plantations near the seashore and on roadside embankments. They are also very common in the uplands of Ceylon.

There is yet another factor operating in the tropics which may lead to the suppression of the growth of the simpler green forms, whilst the blue-green element appears well equipped to withstand it. I refer to the occasional occurrence of periods of desiccation, which, in all probability, come on much more rapidly, and are much more intense in their effect, than they are in our parts. The existence of gelatinous sheaths round the cells of the Cyanophyceæ already referred to above is, no doubt, of immense importance from this point of view, experiment having shown that such forms are able to withstand very prolonged desiccation without coming to harm. In many of the blue-green Algæ these sheaths are tough and hard (e.g. *Lyngbya*, *Tolypothrix*, *Scytonema*, etc.), whilst in others they are highly mucilaginous and slimy (e.g. *Nostoc*, *Aphanocapsa*, *Glœocapsa*, etc.). The former seem more suited for extremes such as obtain in the lowlands of Ceylon than the latter, and it is interesting to note, in this connection, that the slimy forms are very much more abundant in the uplands (*e.g.* at Nuwara Eliya and Hakgalla at a height of 6000 feet and more). There they produce a scenic effect which is in striking contrast to the lowlands. The tree-trunks are frequently covered for several inches

* In certain parts of the tropics, however, species of *Trentepohlia* seem to be wanting (*e.g.* in the Sandwich islands; see Lemmermann, in Engler's *Bot. Jahrb.*, vol. 34, 1905, p. 609).

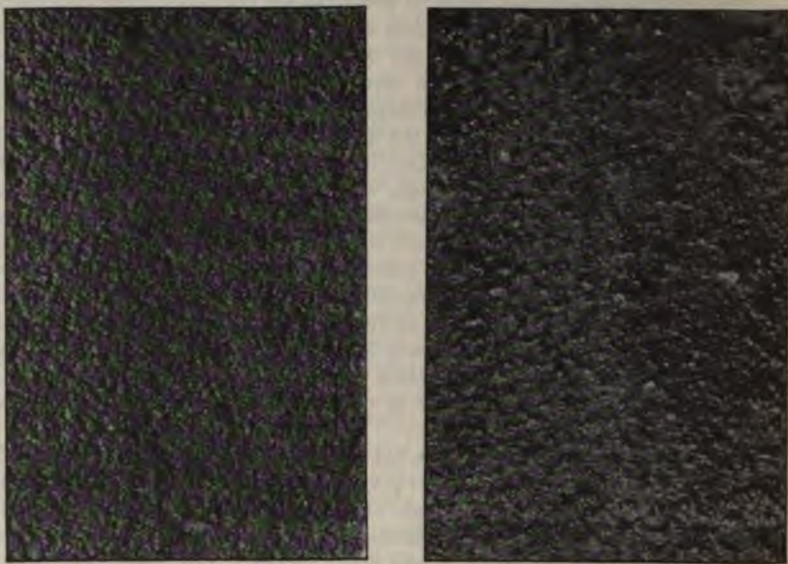
† It may be noted that *Zygnema ericetorum*, which is another green Alga, playing a somewhat similar part in the subaërial vegetation (cf. Bohlin, *loc. cit.*, pp. 50, 51), also has a protective pigment in its cells in the form of the violet phycoporphyrin.

with these mucilaginous masses, which at first recall the resinous exudations often to be seen on wounded trees. At other points similar jelly-like diffluent masses project from amidst the dense growth of Mosses covering the tree-trunks. The relative humidity of the air is much greater in these uplands, and that probably accounts for the very marked difference in the character of the subaërial algal growth. In fact, a mere superficial observation of the algal flora could not long leave one in doubt as to the altitude of any locality in Ceylon. Compare, for instance, the embankment alongside of Lady Horton's walk at Nuwara Eliya with a similar embankment or wall at Colombo or Kalutara. At the time of my visit the former was covered with a thin gelatinous sheet composed mainly of a species of *Schizothrix* (with highly coloured orange-red diffluent sheaths enclosing narrow filaments; apparently *S. Lamyi*, Gomont) with various unicellular blue-green forms (Chroococcaceæ) intermingled, the colouring varying very much at different points, but being prevalently reddish. In the damp lowlands, on the other hand, a similar substratum would either bear a thin filmy growth of bright blue-green *Oscillaria* or of some Chroococcaceous species, or be covered by a sombre tangled or tufted coating.

I must not omit to mention that in the damp tropics subaërial algal growth is not confined to the tree-trunks, etc., but that some of these forms even manage to settle down on the foliage of the luxuriant higher vegetation. One not uncommonly finds various blue-green forms (and species of *Trentepohlia*) as epiphytes on the leaves, although this only obtains in very moist regions. The *Nepenthes*-house at Kew again furnishes good examples, and the photographs on Plate II. (A and B) are taken of leaves from this house. In addition to these more casual epiphytes, a number of genera of the Green Algæ (e.g. *Mycoidea*, *Cephaleuros*) have become highly specialized to life as leaf-epiphytes. They are disc-like forms firmly adherent to the surface of the leaf, and, like *Trentepohlia*, have their chlorophyll protected by the presence of a reddish-brown pigment in the cell-sap.

The preceding facts regarding the scenic effect of Cyanophyceous growth in the tropics become apparent without much detailed study, but a little careful investigation carries one much further. In the first place we should find that the blue-green subaërial element varies considerably in its mode of growth, so that it becomes possible to discriminate between four distinct types; and these types are noticed to succeed one another in a more or less regular manner in the colonization of new ground. The four methods of growth may be distinguished according to their general aspect as adhesive, tangled, tufted, and stratified. The adhesive type (Plate I., A and B) is the simplest and commonest, and is constituted by those forms, which grow as an encrusting film or as a gelatinous mass more or less firmly adherent to the substratum. The most abundant forms showing this type of growth are species of the gelatinous genera *Aphanocapsa*, *Glœocapsa*, *Nostoc*, and of the two filamentous forms *Oscillaria* and *Lyngbya* (especially the section *Phormidium*); typical adhesive films are generally due to the two genera last named. As a rule such films do not attain any considerable thickness. They are probably too compact to allow of the inward diffusion of the necessary amount of air for respiratory purposes, and consequently, where they attain any noticeable development (as in *Phormidium*), the inner portions of the lamellæ are composed of dead filaments. Although this explanation is hypothetical, it affords a satisfactory basis for an understanding of the adhesive and tangled types.

In the tangled type of growth (exhibited by species of *Tolypothrix*, *Hapalosiphon*, *Scytonema*, etc.), which is widely distributed in the moist lowlands of Ceylon, and is not uncommon though rarer in the uplands, we have the algal filaments entangled and interwoven with one another, so as to form wefts of varying degrees of compactness



A B

PHOTOGRAPHS OF ADHESIVE GROWTH OF SUBAËRIAL ALGÆ ON WALLS OF HOT-HOUSES AT KEW.

C D

TANGLED AND TUFTED GROWTH OF SUBAËRIAL ALGÆ ON WALLS OF *NEPENTHES*-HOUSE AT KEW. THE LEFT-HAND PHOTOGRAPH SHOWS COLONIZATION OF THE ALGAL SURFACE BY YOUNG FERNS.

PLATE I.

(Plate I., C; Plate II., C; Fig. 1, the lower part). This arrangement, of course, allows of the retention of a considerable amount of air between the filaments, and hence from the above point of view (viz. respiration) is much more advantageous than an adhesive growth. The air between the filaments would probably get dislodged by every fall of rain, and, as a consequence, it is often in no way manifest. But certain forms seem to take special precautions to prevent the frequent dislodgement of the air by growing in well-protected situations. Such forms, owing to the associated air, which, besides occupying the interspaces of the tangle, also covers its whole surface, are bluish-grey or bluish in colour, and often have a silvery appearance. They constitute quite a characteristic feature of the scenery in some parts of Ceylon. Thus, on the clay embankments round Peradeniya, I commonly found a brick-coloured or brownish-red tufted growth of *Schizothrix* in all exposed situations, whilst, wherever the embankment was more or less protected by an overhanging ledge, there was a dense tangled growth of *Stigonema* (near *St. minutum*, Hass.) exhibiting this characteristic film of air. Similarly, on the black rock which overshadows Dambulla, it is a species of *Tolypothrix* which presents this curious biological feature, being more or less restricted to patches protected by overhanging rocks. It forms greenish or bluish-green or almost white coverings on the rock-surface, having the appearance of fungal growth, the varying colour no doubt depending on the amount of associated air. The algal forms exhibiting this curious phenomenon, however, always show a peculiar incrustation on their sheath, which in one case was due to carbonate of lime, whilst in others it was unaffected by acids, and its nature is still unknown to me. One feels inclined to associate these incrustations with the retention of air, but what the relation between the two is, I am at present unable to say. In any case the air is held very tenaciously, for it has not been in any way displaced by the preserving fluid, which has now surrounded the material for three years.

Although probably advantageous from the respiratory point of view, tangled growth is not favourable to absorption of atmospheric moisture, and consequently we find that, wherever the air is humid, tangled growth sooner or later passes over into the third type—tufted growth (Plate I., D).* In a tangle only occasional filaments stand out to act as capillary threads for the absorption of water-vapour from the air, and consequently this type of growth requires a wet substratum. On a dry substratum water-provision cannot be adequate, and tangled growth will be unsuccessful. Moreover, if the atmosphere is damp, the water-vapour in the air will produce a hydrotropic stimulus, and a number of threads of the tangle will grow out vertically away from the substratum. These threads will eagerly take up moisture, and will exert a strong hydrotropic attraction on neighbouring threads of the tangle. The latter will wind their way round the already outstanding threads, so that a thick wick-like tuft is developed (cf. Fig. 1). And thus the commencement of tufted growth is established. One very often finds thick tufted growth arising from a slight basal tangle of the same species, although sometimes the basal tangle is quite indistinguishable. From the preceding remarks it will have been gathered that certain Cyanophyceæ may exhibit either tangled or tufted growth according to the external conditions; this is the case with species of the genera *Tolypothrix*, *Scytonema*, *Stigonema*, etc. In other forms, however (*Symploca*, *Schizothrix*), the tufted habit is the prevalent one, and most species of these genera do not exhibit much tangled growth, although in all cases there is probably a slight tangle at first. Such purely tufted forms generally settle down on a tangle of some other species (*e.g.* on a *Tolypothrix* or *Scytonema*, cf. Fig. 1).

Tufted growth, although at a distance indistinguishable from a tangle, gives

* Cf. also Fritsch, *Proc. Roy. Soc. London*, Ser. B, vol. **79**, 1907, Fig. 1, p. 209.

a characteristic stamp when viewed from near at hand. When the tufts are closely placed (as in *Schizothrix*, *Tolypothrix*, etc.) we obtain a velvety appearance, recalling a thick and soft carpet, and such growth in the wet season is always saturated with water. In some species of *Symploca*, on the other hand, each tuft appears quite distinct from its neighbour, and the appearance is in striking contrast to that presented by the dense growth of such forms as *Schizothrix*. I am unable to say whether the varying types of tufted growth are due to conditions presented by the environment. But tufted growth in itself is certainly only developed under the conditions indicated in the preceding paragraph; in all dry localities (*e.g.* Anuradhapoora, Negombo), especially if both air and substratum are dry, we get practically no tufted growth except in particularly sheltered positions, whilst the wetter the district the more abundant does such growth become. Tufted growth is, indeed, a natural consequence of the moist heat of the tropics so familiar to all.

The assumption of tangled growth is thus probably due to the needs of respiration, whilst the appearance of tufted growth depends on the necessity of obtaining a better supply of moisture. The fourth mode of growth, which we will call the stratified one, is really only tufted growth which has developed in a certain definite way. The Alga concerned in the cases which I observed was generally some species of *Tolypothrix* or *Scytonema*, but it seems probable that other genera of Cyanophyceæ may also assume this habit. In the stratified mode of growth the tufts are arranged in definite strata one above the other, the tufts in each tier projecting out slightly beyond the tier above and showing a more or less marked downward inclination (cf. Plate II., D.; also at a few points in Plate I., D.). It is not of very common occurrence, and is found mainly on upright walls or tree-trunks in shaded situations. Such stratified growth, however, when developed, usually forms huge coherent sheets, which, with some care, may be detached as a whole (the photograph on Plate II. is made from a small portion of such a one). The appearance is very characteristic, reminding one of the growth of some Mosses. The essential feature of this habit may be a result of the shaded habitat or of the special conditions of moisture. In such extensive tufted growth on a vertical surface the individual tufts would considerably overshadow one another, but by the growth of the Alga in stratified layers, with each tier projecting well out beyond the one above it, this evil is somewhat remedied. In some cases the projecting portions of the tufts are of a different (brighter) colour than the inner shaded parts, and this points to illumination being in some way concerned in producing stratified growth. At the same time, it also seems comprehensible that if a large extent of tufted growth develops, it is advantageous for it to be arranged in downwardly directed tiers, so that each tier may catch up any drops of moisture (from rain), which run off the surface of the one above. Stratified growth is found mainly on substrata which do not furnish much water themselves, and hence it depends to a great extent on the supply of water from the atmosphere. I should think, however, that illumination plays the more important part in determining the stratified habit.

We may now pass on to consider, in slightly greater detail than has been done as yet, the mode of succession of these different types of growth, and the way in which they prepare the ground for higher vegetation; a few more words may also be said on the habitats in which they are customarily found. In the first place, we may note that the only truly successful forms in the subaërial algal vegetation of the uplands are the highly mucilaginous adhesive species, briefly discussed on p. 543. Tufted and tangled growth is rare, being practically absent on tree-trunks, where the Bryophytes and Lichens are too strong for them. Rocks are often without any algal covering, but tangles are sometimes developed on such substrata.

In the lowlands the hard smooth bark of many trees forms an unsuitable substratum for anything but adhesive growth. But in the wet regions, where there are very heavy downpours of rain, adhesive forms will find a difficulty in settling down on exposed substrata owing to the scouring effect of such rainfall. This probably explains how it is that even in very damp districts in the lowlands tree-trunks are often almost destitute of an algal covering.* Should adhesive forms, however, obtain a foothold, they may ultimately make the substratum suitable for tangled or tufted growth, as is not uncommonly seen where there is some protection from the action of the rain. Decayed trunks, of course, afford a much better base, and vie with an embankment in the richness of the algal covering. On such soft substrata, and particularly on an embankment, there is often no adhesive growth at all, especially if the surface is at all rough and crumbly. Tangled growth is very successful here, and since it undoubtedly helps to bind the clay of an embankment together, it will strengthen the latter to resist the effects of rainfall. Smooth objects such as walls, rocks, and some kinds of embankments are invariably colonized by adhesive growth at first, and this gradually prepares the ground for other forms.

The colonization of large smooth rock-surfaces seems particularly interesting, and I will describe a few observations made on the rock leading up to the tank at Nalande. The first forms to obtain a foothold are red-coloured gelatinous species (belonging to the genera *Glœocapsa, Aphanocapsa*) of the adhesive type (small Lichens are also important); these occupy every little crevice in the rock, giving its surface quite a red, granular, speckled appearance at certain points. These places serve as a centre for the growth of *Phormidium* (*P. laminosum* (Ag.), Gom.), another adhesive form, which develops huge thin papery films covering large portions of the rock-surface, as well as for small tangles of other filamentous species (chiefly *Scytonema*), which at diverse points constituted a slippery covering on the rock, making its ascent a by no means easy matter. In some cases the tangle of *Scytonema* was developed directly on the *Phormidium* as a base, or the latter bore a tangled growth of *Tolypothrix* from which very definite tufts arose. These tufts here and there even showed signs of stratification. Here we, therefore, have an interesting succession of the different types of growth, and these diverse forms undoubtedly have a slow but sure disintegrating action on the rock. In dry weather they shrivel up more or less, thus becoming detached from the rock-surface, and at the time of my visit (towards the end of the dry season) there were numerous detached patches, each with a small amount of soil adhering to it, lying about on the surface of the rock. In this way the latter is gradually prepared for vegetation of a higher type, although at most points matters have not as yet got beyond the stage described.

The stages in the colonization of walls are also often easily followed up, and two cases of this kind, noticed at Trincomalie and Kurunegala in Ceylon, may be briefly referred to. The wall at Trincomalie was an ordinary whitewashed one,

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* It may be pointed out, however, that the difficulties of colonization of a tree-trunk may vary very considerably with the nature of the bark. A furrowed bark must constitute a much more favourable substratum in most cases than a smooth one, and a great deal probably also depends on the absorptive capacity of the superficial layer of the bark for water. That the problem is not quite a simple one is shown by superficial observations on the distribution of *Pleurococcus* in our country. Thus, in a country lane not far from London, we have a more or less continuous row of roadside trees, consisting of pines and elms in almost equal numbers, with a few intermingled ashes. The trunks of the pines are completely destitute of algal covering, whilst a rich growth of *Pleurococcus* is found on most of the elms and ashes.

overshadowed by a luxuriant growth of trees, and was almost completely covered by a dense carpet of blue-green Algæ and Mosses, the former often growing in definite vertical lines corresponding to the drip of water from the trees above. Such dense algal growth is rather unusual in the dry northern half of Ceylon, and no doubt its exceptional occurrence in this case is to be accounted for by the sheltered situation of the habitat.* At the base of the dense tufts and tangles constituted by the main mass of the algal growth one could just detect remains of the adhesive forms (members of Chroococcaceæ), which had prepared the way for the subsequent vegetation. These were followed by a tangle of *Scytonema javanicum* (Kütz.), Born., which very soon, however, raised its filaments into tufts, and at many points along the wall these tufts showed a well-marked stratified arrangement. Here again we have all four forms of growth following in succession, but three of them are due to the same Alga (*S. javanicum*). At Kurunegala much the same was observed. At the base a tangle of dead filaments of a *Tolypothrix*, with an admixture of unicellular adhesive forms, probably the survivors of the first algal growth at these points. Above that, tangles of living filaments of the *Tolypothrix*, which in most places had passed over into a dense velvety covering composed of very uniform tufted growth. The latter had become colonized by a few small Mosses, which were being entwined by the filaments sent out by the basal tufts of *Tolypothrix*.† This is an exceedingly interesting relation, which was frequently met with, and requires a brief discussion. Small Mosses, or Liverworts, almost invariably settle down on the subaërial algal growth, as soon as the latter attains a certain degree of thickness, and may be seen as little bright green patches on the dark background formed by the Alga. These Mosses are always more or less saturated with water, and thus exert an attractive influence on the Alga below. Filaments grow out from the latter and wind their way round the Moss, and as their number increases the Moss of course tends to get smothered. Its only way of saving itself is to grow on in front, and thus escape the attacks of the Alga. The latter, however, slowly but surely follows up its advantage, and in this way a thick stratum of vegetable growth accumulates, forming a humus on which small ferns, etc., soon settle down. This process is probably of great importance in rapid colonization of a substratum. In some cases I have seen the same relation holding good between the isolated tufts of a *Symploca* and the basal tangle of a *Tolypothrix*, etc., on which it had settled down (Fig. 1), and here again the activity of the two forms no doubt leads to the accumulation of a considerable mass of algal substance in a relatively short space of time.

The arrangement of the algal growth on the wall at Trincomalie in definite vertical lines determined by the drops of moisture falling from the trees above is a common phenomenon, noticeable even on the tree-trunks, etc., in temperate regions, and particularly striking in some of the hothouses at Kew (cf. Plate I., B). The distribution of moisture, however, also determines other peculiarities of the mode of growth of the subaërial Algæ. In the case of rugged vertical surfaces (such as a rough wall) moisture, of course, collects most readily around the outstanding points, and these are the first to become colonized by algal growth. In sheltered situations this state of affairs often obtains for a considerable length of time before the whole surface becomes overgrown. On the other hand, if the rough surface be horizontal, we very frequently find small gelatinous colonies of one or more

* It is not quite impossible that the richness of this growth is also partially due to the neighbourhood of the sea. The presence of such a huge mass of water must lead to greater humidity of the air.

† Cf. Fritsch, *loc. cit.*, fig. 2.

unicellular forms settling down mainly in the excavations which receive most water (cf. what was said above about the rock at Nalande). These colonies are often not much larger than a pin's head, and in the case of a rock are so firmly lodged in the small hollows that they are not easy to remove. They form centres from which the growth extends outwards. The growth of epiphyllous Cyanophyceæ (see Plate II., A and B) also furnishes frequent examples of the importance of moisture for the growth of these forms. Thus in the case of the leaf of *Anthurium radicans* shown on Plate II., A, the Alga is evidently crowded into the lower portions

FIG. 1.—STRUGGLE FOR DOMINANCE BETWEEN A *TOLYPOTHRIX* AND *SYMPLOCA* (× 85 ABOUT).

At the base is a tangle of *Tolypothrix*, on which tufts of a *Symploca* (the dark shaded mass) have settled down. Numerous filaments arising from the basal tangle of *Tolypothrix* are winding their way round the *Symploca* tufts, almost completely covering them in some places. Note the way in which the tufts of the *Symploca* branch, the branches frequently contributing to the increase of neighbouring tufts. In the *Tolypothrix* only the sheaths of the filaments are shown.

(*i.e.* those nearest the drip-tip) of the channels formed by the deeply furrowed veins. These are the parts of the leaf-surface which are continually draining off the excess of moisture, and the latter comes to benefit the Alga concerned.

As an outcome of what has been described in the preceding pages we see that subaërial algal growth in the tropics gives its own peculiar character to the scenery in many regions, and probably plays a very important part in the progressive colonization of exposed surfaces. These Algæ, which so readily settle down on almost any object when the conditions of moisture and temperature are favourable, are

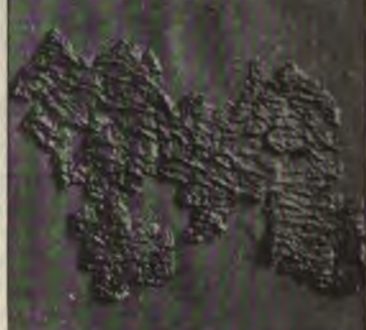
A

B

LEAVES FROM THE *NEPENTHES*-HOUSE AT KEW BEARING EPIPHYLLOUS BLUE-GREEN ALGÆ.

C

TANGLED GROWTH OF ALGÆ ON A ROCK IN THE *NEPENTHES*-HOUSE, KEW.



D

STRATIFIED GROWTH OF A *TOLYPOTHRIX* ON TREE-TRUNKS, CEYLON.

PLATE II.

certainly in large measure the agents to which the tropics owe the wealth of vegetation on every available substratum. The rapidity with which colonization is effected is often striking. I remember, on my arrival in Colombo, noticing a newly whitewashed wall absolutely destitute of visible traces of algal growth. I passed this wall again less than a week later, and it bore a bright blue-green film of some *Oscillaria*, although still uncovered at many points. Three weeks elapsed before I again saw it, but now it was one blue-green film with practically none of the whitewash visible. Careful examination, moreover, showed that tangles were appearing at a few points. When I left the island about three months after my arrival, the wall was nearly completely covered by tangled growth, and at many points tufts had arisen, whilst small Mosses were already growing on the tangle. I am informed that in the damp hothouses at Kew newly whitewashed walls tend to become covered with a thin film of blue-green Algæ in about six weeks, although the length of time required varies according to the temperature and degree of moisture.

I am not sufficiently familiar with districts having a heavy rainfall in our parts of the world to say whether algal growth ever plays the same sort of part it does in the damp tropics, but I should think not, for the stimulating effect of the high temperature is wanting. Gelatinous adhesive forms may sometimes develop in quantity on a rock-surface, etc., when the latter for some reason is exceptionally moist, but I have never seen other kinds of growth in any amount. This tallies with the prevalence of gelatinous Algæ in the subaërial algal flora of the uplands of Ceylon (cf. p. 533), which, although they have a high rainfall, of course have a relatively low average temperature (mean annual temperature a little over 60° Fahr.). I hope, subsequently, to be able to study subaërial algal growth in damp regions in Europe, but for the present must refrain from further observations on this subject. No doubt the experience gained in the tropics will be of immense value in interpreting the problems presented in temperate regions, and the study of this subject could not have been commenced in a better field than is to be found in the damp tropics.

The Cyanophyceæ, in fact all subaërial Algæ, may be described as semi-aquatics. They still require more or less frequent saturation with water for successful development, and consequently they can only play an important part where the substratum is periodically very moist, or the relative humidity of the air high. Many subaërial Algæ have got over this difficulty by undergoing symbiotic combination with a Fungus to form a Lichen. Within the mycelial weft of the Fungus the Alga finds adequate protection from desiccation, whilst the Fungus is much better equipped to collect such moisture as the substratum may afford, and to pass part of it on to the Alga. And, consequently, the ordinary growth on rocks and tree-trunks, etc., in temperate regions is nearly always of the nature of a Lichen. Every one is familiar with the many-hued Lichen-covering on the rocks in the high Alps, etc., and much the same sort of growth is of course often to be seen on the trunks of our forest trees.

We may now briefly consider certain cases illustrating the *rôle* of aquatic Algæ in preparing ground for higher vegetation, but the data I have to offer on this side of the subject are, I fear, rather meagre. The action of such aquatic Algæ is in great part a manuring one, but in some cases, at least, they help in the accumulation of a soil or in the absorption of moisture, which comes to benefit the higher vegetation growing amidst them. Cases of this kind are described by Welwitsch and W. and G. S. West. The former * deals with the abundant occurrence of a

* Welwitsch, "The Pedras Negras of Pungo Andongo in Angola," *Journ. of Travel and Nat. Hist.*, vol. 1, 1868.

Scytonema (= *Porphyrosiphon Notarisii*) in the damp sandy upper valley of the Cuanza river (Angola). According to this observer, it "frequently extends across the wide meadows, closely spread like a net over the soil, intergrown with the other herbs and smaller shrubs. Through its hygroscopic nature, it eagerly absorbs the atmospheric moisture during the dewy nights, affording by this means a refreshing protection to the roots of many other and larger plants during the glowing heat of the following day. The growth and thriving of the numerous small Phanerogamous plants in these places is conditional on the co-presence of the prolific *Scytonema*." In citing this description of Welwitsch's, Messrs. W. and G. S. West* refer to analogous observations made by them on the sandy heaths of the south and some parts of the north of England. According to their account, "at the drier and hotter periods of the year, thickly matted sheets of ***Zygnema ericetorum*** are to be found extending over wide patches of almost bare sand, round such plants as ***Drosera***, ***Carices***, etc. These interlacing masses have great absorptive capacity, greedily taking up water; it is also highly probable that they protect and render the growth of other plants more possible by regulating the moisture of the surface soil. It is interesting to note that ***Zygnema ericetorum*** is found intermixed in small quantity with the ***Porphyrosiphon Notarisii***, which covers such extensive areas in Angola." In both of the cases quoted, I think it probable that the Alga has an important manuring effect on the soil in addition to the other functions indicated.

I will, in the first place, describe a similar case from a salt marsh in the Bouche d'Erquy, in Brittany. Extensive vegetation-studies have been carried on during the past three summers at Erquy by the staff and students of the Botanical Department, University College, London, and in this connection certain observations of a preliminary nature have been made on the influence of the abundant algal growth on the colonization of new ground in the marsh. Scattered all over the latter are small pools of varying size—the pans. According to the level they occupy, these pans are more or less frequently overrun by the tides, and their water is consequently brackish. They harbour a rich growth of *Rhizoclonium* and *Lyngbya*, often intermingled with abundant colonies of *Chroococcus*, etc., and Diatoms; in some pans the *Rhizoclonium* predominates, in others the *Lyngbya*. The algal growth is often very thick, and when this is the case near the shallow edges of a pan, the algal weft, together with the mud and sand silted up between its filaments, gradually forms a soil on which *Salicornia* and subsequently *Suæda* settle down. In this way some of the pans appear to be slowly filling up, and are becoming populated by the neighbouring marsh-plants. It is not quite impossible that some of the pans themselves are due to the operation of the same sort of silting-up process on the tributaries of the river, which passes through the marsh. Moreover, in whole areas of the marsh the soil is rich in filaments of *Rhizoclonium* or *Lyngbya*, these filaments being more or less decayed and giving the sand or mud a dark black colour. The brackish Algæ at Erquy thus appear to play an important part, not only in the formation of new soil, but as humus-producers. In many parts of the marsh the *Rhizoclonium* also forms a bright green weft, covering the soil and ramifying through the superficial strata for long distances in a way evidently comparable to the cases described by Welwitsch and Messrs. W. and G. S. West. Such a covering probably affords an excellent moist substratum for the growth of the higher vegetation. Moreover, almost every tide will probably deposit a small amount of mud and sand on the surface of the Alga, and the latter will thus gradually become embedded. The buried portion will form humus by decay, whilst fresh branches from the Alga will continue the growth on the surface. The soil thus formed constitutes a black evil-smelling sandy mud, owing to the decomposing algal

* *Journal of Botany*, vol. **35**, 1897, pp. 303, 304.

substance. Borings have shown that strata of a similar black sandy character are present at varying depths below the present level, and they no doubt testify to the occurrence of similar processes to those mentioned above at earlier periods in the history of the marsh.

We may next notice somewhat analogous phenomena recently described by W. G. Smith.* In dealing with the vegetation of sandy shores and sand-dunes in the botanical survey of Forfar and Fife, he mentions how "the hollows or troughs between the dune-ridges nearest the sea are sandy flats devoid of vegetation and still liable to inundation at high tide. When completely enclosed by protecting ridges, the dune-hollows become occasional pools of rain-water, where fine dust and organic materials collect. The catch-water has as its first vegetation evanescent growths of slimy blue-green and green Algæ, which aid in consolidating the bottom, and add to the organic matter till the soil is impervious enough to retain water throughout the winter and spring." This recalls Moss's description of the formation of moor-pan on the edges of many of the cotton-grass moors of the Pennines.† Such moor-pan is "initiated by the growth of slimy Algæ, of Lichens, of small Liverworts . . . on the bare earth and at the bases of the stems of the larger plants. . . . Over the remains of the pan-forming plants the creeping stems of heath-plants spread; and seedlings of the shrubby heath-plants also begin to grow." Both of these cases, though not directly comparable to the phenomena observed at Erquy, are parallel in their nature.

My friend, Mr. L. A. Boodle, has kindly drawn my attention to a very striking example of accumulation of algal growth leading to the production of a crust on the soil. This crust consists of a curious substance resembling elastic bitumen, and is found on the surface of the ground in South Australia. It is apparently derived by drying and other changes from an accumulation of gelatinous Algæ, Diatoms, etc. A similar deposit, which seems to be due to a member of the Cyanophyceæ, has been found in tropical Africa. I refrain from further discussion, as a description of these cases has just been published in the Kew *Bulletin*.‡ Earlier accounts of the Australian deposit are to be found in articles by W. T. Thiselton Dyer § and J. R. Jackson.‖

I made somewhat similar observations on some of the tanks or irrigation-reservoirs in Ceylon. During the dry season the water-surface often shrinks to a small fraction of its original area, and a large portion of the bottom of the tank becomes exposed. This latter appears as a soft black mud near the water's edge, but further away is hard and cakey, being traversed by cracks running in all directions. The softer portion often bears a considerable quantity of algal growth, which gets on well until this mud also dries up. The hard cakey part away from the water's edge always shows remains of algal growth, and its substance is generally found to be impregnated with algal filaments to some slight depth (1 or 2 inches). The surface, moreover, is often covered with abundant bleached remains of higher aquatics (*e.g.* at Lake Kantelai), so that this hard ground is well manured. In spite of this, it is only rarely found to bear a growth of higher terrestrial plants. This is no doubt due to the dried substratum and strong insolation of the tropical sun, against which there

* *Scottish Geographical Magazine*, vol. **21**, 1905, p. 69.

† *Geographical Journal*, May, 1904, p. 10 (separate copy).

‡ L. A. Boodle, in 'Bulletin of Miscellaneous Information, Royal Botanic Gardens, Kew,' No. 5, 1907, pp. 145 *et seq.*

§ "On a Substance known as 'Australian Caoutchouc,'" *Journal of Botany*, New Ser., vol. **1**, 1872, pp. 103–106. In this paper a number of similar cases are also mentioned (pp. 104, 105).

‖ "Coorongite, or Mineral Caoutchouc of South Australia," *Pharm. Journ. and Trans.*, 3rd series, vol. **2**, 1871–72, pp. 763 *et seq.*

are no means of protection. In some few of the tanks, however, the height attained by the water-level in the wet season is decreasing for some reason or other, and certain portions of the bottom near the edge of the tank are permanently exposed. These ultimately become colonized by quite a rich growth of land-plants, which no doubt by their progressive advance are able to overcome the difficulties of a dried substratum and intense insolation, and find favourable conditions in the well-manured soil. Similar phenomena on a smaller scale are common enough in Ceylon.*

In our parts of the world the same thing may be seen in the gradual encroachment of marsh-plants on a piece of water.† Sinking of the water-level, of course, always takes place in a hot summer, and if the water concerned is shallow, a certain amount of the bottom will become exposed. The area thus exposed, however, is not subjected to such extreme conditions as obtain in the tropics; especially if a considerable mass of water-plants is left by the retiring water, the exposed strip will tend to remain somewhat marshy in character, and will therefore be invaded by marsh-plants. If exposure is sufficiently long to enable the latter to obtain a proper footing, most of them will hold their own even after the return of the water. The growth of water-plants, and more particularly of filamentous Algæ, between the bases of the stems of these marsh-plants and the sediment washed in amongst the former will gradually cause silting up, and the marsh will become more pronounced. Of course, it frequently happens that a considerable rise of the water-level takes place, and makes matters impossible for the marsh-plants, which then have to retire to their own ground. Good examples of this kind may be seen on Sheen Common, Richmond. A number of the small pools there show a constant struggle between the water and these marsh-plants, resulting now in the victory of the one, now in that of the other; but, as far as I can see, in this case it never leads to an end.

One of these pools on Sheen Common shows another phenomenon, which is of interest to us here; and I was able to study several examples of the same kind in Ceylon.‡ I refer to the formation of deposits of reddish-brown hydroxide of iron, which often accumulates in very considerable quantities on the bottoms of pools, whose waters contain a certain amount of dissolved iron salts. There is a remarkable uniformity in the algal flora of such pools, which are characterized by containing an often very abundant Conjugate flora (species of *Spirogyra*, *Zygnema*, *Pleurotænium*, *Closterium*, *Netrium*), as well as forms like *Œdogonium*, *Ulothrix* and Diatoms (species of *Pinnularia*, *Navicula*, *Surirella*, *Synedra lunaris*). The filamentous Algæ and larger water-plants occurring in these pools are generally found to have their filaments coated by a granular or filmy covering of this ferric hydroxide, so much so that they are often completely obscured. There seems no other way for accounting for this investment than by assuming that it owes its presence on the surface of the plant-growth to the metabolic processes of the latter; probably the dissolved iron salts in the water are oxydized by the activities of the plants, and are then precipitated as insoluble ferric hydroxide.§ As the latter accumulates it will sink down to the bottom of the piece of water, thus giving rise to a characteristic

* A very striking case (that of Lob Nor in Central Asia) of an analogous kind is mentioned on pp. 462, 463 of the *Geogr. Journal*, vol. 27, 1906 (discussion by Sir T. Holdich of Scott Elliot's paper).

† Cf. Pawson, "Water-plants as Land-winners," *Naturalist*, No. 511, 1898; also, Moss, *loc. cit.*, p. 6 (separate copy).

‡ Cf. Fritsch, *Proc. Roy. Soc. London*, Ser. B, vol. 79, 1907, Sect. *b* (ii.), pp. 236 *et seq.*

§ Similar deposits are known to be formed as a result of the activity of iron-bacteria. Such Bacteria may also to some extent be concerned in the case described, although in early stages at least, they were not found to be present. Cf. also Hanstein, in *Sitz. ber. d. Niederrhein. Ges. Bonn*, 1878, pp. 73–75.

granular deposit. The plant-growth in the water, moreover, as it dies away will fall to the bottom, and bring a further mass of reddish-brown hydroxide with it. In Ceylon I observed many different pools suggesting different stages in this process. Some had no bottom-deposit at all, but merely a red flocculent or filmy covering on the aquatic vegetation; in others there was a certain amount of deposit in addition to an abundant covering on the plant-growth. The final stage is found in pools with a thick red deposit all over the bottom, but little or no macroscopic plant-growth. It appears as though extensive accumulation of the deposit leads to unfavourable conditions for the continuance of vegetation, although in the absence of consecutive observations of the same pool it is difficult to say whether this is a passing phase or not. In the Sheen Common pool above mentioned accumulation of the red deposit is going on steadily, and has at sundry times appeared to have a very depressing influence on the algal vegetation, although as yet the latter has generally managed to recover. I hope to be able to study this interesting subject in greater detail subsequently; a few more facts about it are contained in my general paper on the Algæ of Ceylon (*loc. cit.*).

Such deposits must, of course, involve a gradual shallowing of the piece of water, and from this point of view they interest us here. We have the formation of a peculiar kind of soil as a result of algal activity.

Finally, I desire to briefly refer to an interesting occurrence of terrestrial Algæ on the seashore in many parts of Ceylon.* On the sandy spit which fringes in the lagoon at Kalutara, large quantities of a foliose *Nostoc* are to be found lying loosely on the sand amongst the numerous fruits (some of them, e.g. *Cerbera*, *Otodes*, had germinated and formed seedlings) cast up with the drift. At Bentotta and Matara the same form is found on the sand of the seashore above high-tide level. It lies loosely on the shore, and at a first glance is difficult to distinguish from the dead blackened leaves of the *Ipomœa Pes-Capræ*, which grows in abundance in the same locality. It appears that this *Nostoc* favours a sandy substratum, for it was found in quantity in the coconut plantations at the back of the beach as far as the sandy soil extended, and was also met with about 2 miles inland near the Bentotta river—again growing on sand. This species has markedly xerophytic characters, which are in keeping with its habitat. The colony is surrounded by a tough outer sheath, which does not swell up in water, and each of the contained filaments has a fairly compact yellowish sheath of its own. Its only source of water can be atmospheric moisture in the form of dew or rain, and hence the necessity for adequate protection from desiccation in the form of thick sheaths. The point that interests us most here is the possible important manuring effect of this abundant form, large masses of which are often found to be overgrown by the *Ipomœa*. It may also, by the absorption of atmospheric moisture, play much the same part as the Algæ described by Welwitsch and the Wests in supplying moisture to the plants of the tropical sandy shore.

In concluding this paper, I should like to point out that many of the phenomena dealt with are readily observed, and do not require protracted investigation. It would be highly valuable if travellers would devote a little attention to such features, and would contribute data as to their distribution and relative importance in different regions of the Earth.†

* Cf. also Tansley and Fritsch, "The Flora of the Ceylon Littoral," *New Phytologist*, vol. 4, No. 1, 1905, pp. 13, 14.

† Many of the results recorded in the present paper were obtained with the help of a grant from the Government Grant Committee of the Royal Society, to whom I am much indebted for the assistance thus offered me. I should also mention that Fig. 1 is the work of my wife.

DESCRIPTION OF THE PLATES.

PLATE I.—Photographs illustrating the colonization of bare surfaces by subaërial Cyanophyceæ in the hothouses of the Royal Botanic Gardens, Kew. A, dense gelatinous adhesive growth on north wall of Aroid house; tangles are appearing at a number of points. B, adhesive growth on wall in tropical fern-house; the growth consists of large gelatinous masses of *Nostoc* and *Glœocapsa*. C, colonization of a rock-surface in the *Nepenthes*-house. Dense tangle of a *Scytonema*, covering an adhesive base (not visible), the tangle being overgrown by young ferns. D, tangled and tufted growth of blue-green Algæ on walls in *Nepenthes*-house.

PLATE II.—A, photograph of a leaf of *Anthurium radicans* from the *Nepenthes*-house at Kew, bearing a dense growth of epiphyllous Cyanophyceæ; the Alga is mainly present in the furrowed veins in the upper half of the leaf. B, leaf of *Nyrosma kummeriana*, bearing numerous rounded patches of epiphyllous Cyanophyceæ (*Nepenthes*-house, Kew), which appear as dark areas. C, typical tangled growth of a *Scytonema* on a rock in the *Nepenthes*-house at Kew. D, portion of a sheet of a stratified *Tolypothrix*, found on tree-trunks, Ambalangodda, Ceylon.

REVIEWS.

EUROPE.

PHYSICAL HISTORY OF DEVONSHIRE.

'The History of Devonshire Scenery.' By Arthur W. Clayden. London: Chatto & Windus. 1906.

THERE are few counties in England which possess a more varied succession of rocks than Devonshire. They range from Lower Devonian, at least, to Pleistocene, and probably among the schists of the Start and the slates of North Devon formations older than the Devonian may be represented. Mr. Clayden has set himself the task of depicting the changes through which the county has passed in such a way as to make them intelligible and interesting to a reader not specially versed in geological methods. He is intimately familiar with much of the field evidence, and knows how to direct his readers to the localities where they may find for themselves the proofs of his assertions. The book, moreover, is adequately illustrated with reproductions from photographs, and with a limited number of maps. To those who know the district this volume is full of charm, and geologists must praise the lucid and vigorous treatment which the subject receives at the author's hands. Of course, there is much that is obscure and controversial in the past history of Devonshire, and these difficulties are not to be avoided, but they are not allowed to obtrude themselves unduly on our notice. The later chapters are devoted to the origin of the present scenery, the history of the river-valleys, and their relations to the earlier plateaux which form so well-marked features of the general landscape. From all Devonians and all who have made or are to make a tour in Devon this work well deserves a careful perusal. It is evidently the fruit of years of special study and of a close acquaintance with the results of geological investigation in the west of England. J. S. F.

A CORNER OF DEVONSHIRE.

'The Hills and Valleys of Torquay.' By A. J. Jukes-Browne. Torquay: published by the Author. 1907.

In Mr. Jukes-Browne's latest work we have a complete little monograph of the scenery of a small but intensely interesting corner of England. The geological

structures around Torquay are complex, and the rocks have been much faulted. The older plateaus have been deeply incised by modern river-valleys, and these last have passed through several stages of development before attaining their present condition. The interest of the problems examined is mostly of a strictly local character, but larger issues lie behind. Possessing a ripe knowledge of English geology and wide experience in the field, the author leads us from the local phenomena to questions of British geological history. The book is meant chiefly for visitors to Torquay, and is illustrated by large-scale maps from actual survey. No one can read it without seeing how complicated are the problems raised by the surface configuration of even a very limited area, and how much useful scientific work can be done by those who are prepared to devote their leisure to an analysis of the causes which have produced some of our most familiar landscapes.

J. S. F.

Macedonia.

'Makedonische Fahrten. I. Chalkidike.' By Adolph Struck. *Illustrated.* Pp. 88. Vienna and Liepzig: A. Hartleben's Verlag. 1907.

This is the fourth part in the series edited by Dr. Carl Patsch, of Serajevo, 'Zur Kunde des Balkanhalbinsel,' and the first contributed by Dr. Adolph Struck, who fills the office of librarian in the German Institute at Athens, and has travelled much in Macedonia. The author's object has been archæological, and we do not gather that he claims any cartographical knowledge. The chart appended to his description is based on the well-known Austrian staff map. The volume contains a running description of routes and stations, based on a journey which showed the author all the Chalcidic peninsula except its easternmost prong, the Holy mountains, already sufficiently well known. There are notes on points of history and ancient topography; but in the main Dr. Struck gives a superficial description of the gazetteer or guide-book kind.

ASIA.

Armenia.

'The Geology of Armenia. By Felix Oswald, B.A., D.SC. Beeston, Notts.: published by the Author. 1906.

This work deserves a warm welcome, not only as a contribution to geological literature, but also as an example of self-help in the world of scientific work. The author accompanied Mr. Lynch in his travels in Armenia in 1891, and the first part of this book, consisting of the geological results of that expedition, was originally prepared as a thesis for the University of London. The second portion is a summary of all that is known at the present time of the geology of Armenia. With the palæontology he has had the help of specialists in the British Museum, but the numerous petrographical notes and the geological descriptions have been prepared by himself. In one respect the book is probably unique: it has been printed and published by the author. The illustrations are also his own work, and are reproduced by the autocopyist or some similar process.

The account of the special geology of Armenia is prefaced by an account of the relations between this portion of Asia and the adjacent continents. Armenia is regarded as a plateau or syncline lying between the upfolded Taurus and the Pontic ranges. It is held to be homologous with the high tableland of Tibet, and its bounding ridges correspond to the Himalayas and the Kuenlun mountains. The main structural lines of the country have an east-and-west direction, which finds expression in the orientation of the mountain chains, such as the Taurus, the Karabagh, and the Shatin Dagh. The principal folding appears to have taken

place in Mesozoic and early Tertiary times, and the author believes that the post-Miocene movements which gave the Caucasus its present importance produced little plication in Armenia. The tableland, already folded, was now fractured into blocks bounded by faults which have usually the same trend as the Caucasus. These faults traverse the older systems of folds, and along them great volcanic outbursts have taken place.

The Armenian plateau is covered with volcanoes, some of them probably not yet extinct. The most noteworthy of these lie along a line which Dr. Oswald regards as a continuation of the fissures which pass through the Jordan valley and the Red-sea depression into the rift-valley of Africa. Nimrud, Sipan, Tandurek, and Ararat are all placed upon this line. Nimrud is one of the most interesting volcanoes of Asia; its last eruption was in 1441. Dr. Oswald is the first scientific man to give an accurate account of it; his sketches, maps, and geological sections enable us to form a very clear idea of its appearance and geological structure. The crater, which contains a lake, is nearly 5 miles in diameter, and is one of the largest known. The mountain rises about 4000 feet above Lake Van, and the crater is about 2000 feet deep. Within it there are many lava-flows, and in its southern portion a new crater (1¼ mile in diameter) has been formed. The petrographical descriptions show that olivine basalt, trachyte, rhyolite, and obsidian have been emitted by this vent. The country around Nimrud has been flooded with extensive sheets of basalt; these cross the plains and form a dam 670 feet in height, holding up the waters of Lake Van. They entered some of the existing river-valleys and partly filled them—a fact which proves how recent these eruptions were. Violent earthquakes still take place in this district; one occurred on May 30, 1881, destroying a village which stood at the base of the crater wall.

The second part of the book provides a useful conspectus of the available information on Armenian geology, and is completed by a bibliographical appendix. The work is in every way an important contribution to the geology of Asia, and will serve as a standard work of reference for many years to come.

J. S. F.

AFRICA.

The Ethnography of Central Nigeria.

'Le Plateau Central Nigérien: Une Mission Archéologique et Ethnographique au Soudan Français.' By Lieut. Louis Desplagnes. Paris: Emile Larose, Rue Victor Cousin.

This French study of the ethnography of the Central Niger—that is to say, of the region lying to the north of 13° N. lat., east of Senegambia, south of the Sahara desert, and west of Sokoto—is, to use a very hackneyed phrase, epoch-making. So little of real scientific value has as yet been written and published on the ancient and modern races of Africa, that this work is likely to be remarkable. It can only be compared with the studies of Schweinfurth, Bleek, Delafosse, Flinders Petrie, Barth, Duveyrier, Nachtigal, Révoil, Foureau, Xavier Stainier, Dr. Hamy, the anonymous authors of 'Notes Analytiques sur les Collections Ethnographiques du Musée du Congo;' of Koelle, Fülleborn, Binger, R. N. Hall, and of George Stow, author of 'The Native Races of South Africa.'

It is sad to note that only three of these names are English, and that England, as compared to France, Germany, Belgium, and Italy—even Portugal—has made so little use of her opportunities as the power with the greatest amount of African territory under her control to investigate the past history of man in Africa, especially in the regions outside the Mediterranean basin.

Had this book been published in England, instead of being sold in one volume

at the modest price of ten shillings (illustrated as it is with 119 admirable photographs and an excellent map), it would have been made up into two heavy volumes, and priced at twenty-five shillings, or some other figure much beyond the resources of most African students. This is a work which will be largely quoted from, with or without acknowledgment. It is the first serious study of the ethnography of western Nigeria. It commences with a geographical and mineralogical study admirably illustrated. By this we are enabled for the first time to realize the extraordinary scenery of the Hombori or Tombori region, first revealed to us by Barth, whose little sketches, primly reproduced in woodcuts, of the fantastic mountain scenery seemed too extraordinary for belief, though they are now to a great extent borne out by Lieut. Desplagne's photographs. These illustrate not only the natural columns, the fingers, spikes, sugar-loaves, and plateau walls of the mountainous region lying between the Niger of the Hausas and the Niger of the Mandingos, but they also reproduce for us the flooded plains, the palm-crested hillocks, the wide rivers and reedy lakes of the lacustrine region of the western Niger. From these and from the map we are enabled to realize that at no very distant period the upper Niger and its affluent the Bani must, when they descended from the mountains of Liberia and Senegambia, have fed a vast shallow lake, three or four times the size of the Victoria Nyanza.

Delineating the vast human history of this region from the collection and comparison of records and traditions, and, above all, from the prehistoric remains, the author of the book deduces that the first human inhabitants of western Nigeria were yellow-skinned Pygmies, apparently (from the description given) resembling some of the Pygmy races existing in the Congo forest to-day, or the Pygmies still lingering in East Africa, even, it may be, the Pygmy races of South-West Africa. Into this country then came big black Negroes from the east, following especially the course of rivers—negroes of the tall, long-legged Nilotic type, and "forest" negroes of the burly, short-legged variety. Then, after an interval, "neolithic" races of the Caucasian species arrived from the north, and also from the east. Apparently, the first of these Caucasian invaders was a shepherd race, akin to the modern Fulas; a race that must have brought with them most of, if not all, the domestic animals which existed in this and in other parts of Negro Africa prior to the coming of the Portuguese or the Arab—that is to say, the dog, ox, goat, and sheep. Whether these primitive Caucasians of a Fula-like type were identical with the neolithic people that ranged across North Negro-Africa from Senegambia to Somaliland, the author and his commentators are not quite decided. In some passages Lieut. Desplagnes speaks of the Fulas as a non-progressive people who have been and are little else than herdsmen, a race that has never lifted itself out of the pastoral age, which may have to a great extent preceded that in which neolithic weapons or the working of metals were invented.

It may be noticed, in passing, that Lieut. Desplagnes, far reaching as his researches are, does not seem to have sufficiently grasped the main features of the Fulu language. He repeats without disapproval the somewhat fantastic theories based on the writings of Sultan Bello, that the Fulas came direct and at no very distant period from the east—from the Red sea; that they are even an Asiatic race. Sultan Bello's fragment of historical notes, which was brought home by the traveller Clapperton, is really of very little value to serious students of Africa. It is a jumble of more or less nonsensical traditions derived from the Koran or from Arab legends. The oral traditions of Negroes and Negroids are not underrated in their importance by the present writer; they may often give a clue to the past history of the race. At the same time they may be easily disturbed and falsified by the influence of a superior invading race, or warped by the unscientific guess of

some native philosopher. Races who declare themselves to be the autochthones may not have been in their present habitat for more than three hundred years. Others, again, who ascribe to themselves descent from an Arab invader or Jewish monarch may have been living more or less where we now find them for ten thousand years.

In *language* the Fulas are connected with purely Negro races living here and there in the West African hinterland, and also, much more distantly, with the fundamental stock of the great Bantu family. Corporeally, they are closely related to the Ethiopians, to the Galla aristocracy in eastern Africa, even to some of the earlier non-Negro races of Egypt. They are, of course, largely impregnated with Negro blood, as are all the races of Africa, not even excluding the Berbers of the north. They are, in fact, more properly classed with the Negro than with the Caucasian, though they are nearly a half and half mixture between the two types. Evidently they and many other Ethiopian and North African races represent the earliest mixture between the invading Caucasian from the Mediterranean basin and the primitive big black Negroes of tropical Africa. As to the relations in history and origin of the big black Negro type and the yellower Pygmy negro, science has not yet pronounced her decision. At any rate, prehistorically, the two types seem to have co-existed and to have frequently fused. At the present day the black Negro type seems to be divided into two main stocks (suggests Lieut. Desplagnes, in interesting conformity with the views of other writers, of which he may not be aware)—the burly, short-legged, long-armed type (once described by the present writer as the "forest" Negro), and the long-legged, less prognathous Nilotic Negro. The first race is more associated with the forests, and the latter with the plains and the shores of lakes and rivers. The Nilotic type, so characteristically developed in the upper Nile valley, stretches right across North-Central Africa to Senegambia, and also southwards, in various degrees of intermixture with the Bantu peoples of Southern Africa.

Lieut. Desplagnes indicates in his human history of Nigeria that after the Dwarfs and the black Negroes were succeeded and supplanted by a primitive Caucasian type (the Fula), there arrived other and more important invasions of the Libyans from the north, of people allied to the modern Berbers. These invasions began far back in the periods coincident with civilized Egypt, and have, as we know, continued down to the present day, and have been to a certain extent further influenced and reinforced by the extension of Arab influence in the centuries which succeeded the uprising of Muhammadanism. Some of this Arab influence reached Nigeria from due east. Much of it, however, came from Morocco, Tunis, and Tripoli. Somewhere about the thirteenth century commenced the subjugation of western Nigeria by the Mandingos, at first by a section of these people, seemingly identical with the modern Susus. This Mandingo invasion of Western Africa, according to tradition, was associated with the riding of horses, and came from the far east, from the direction of Hausaland.* These Mandingo clans swept

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* The author of this book points out a fact (which is easily confirmed by reference to comparative vocabularies) of the almost universality of the root meaning "horse" amongst all peoples speaking Mandingo languages, and he suggests an Egyptian origin for this term for horse, as though the horse had reached eastern Negroland from Egypt, carrying with it an Egyptian designation. Another point, to which he makes no reference, is the resemblance in the negative particle, and in some numerals of the Mandingo languages to roots for the same concepts in the Nilotic Negro tongues, the influence of which extends westwards nearly as far as the Shari river. Mandingo civilization also is emphatically Bantu, as though this

across the bend of the Niger at the back of the forest region and established themselves once and for all in western Nigeria. Their power lasted more or less till the invasion of the Moors in the seventeenth century, and the uprising of the Fulas in the eighteenth.

This is a very rough summary of the careful and elaborate studies and theories of Lieut. Desplagnes. It is very difficult in a review to do justice to a work written with so much care and detail, and one which here and there faces us with rash conclusions and dogmatic assertions. These command attention, though they may not always obtain belief. Lieut. Desplagnes attaches perhaps too much importance to the traditions collected and transmitted by classical writers on geography—Herodotus and Pliny—and his insufficient acquaintance with African languages makes him in this respect too uncritical. But the positive knowledge accumulated and recorded by himself is worthy of high praise.

H. H. Johnston.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Steppe Denudation.

'Denudatsiya Stepi.' A. Ivchenko. In three parts. St. Petersburg: Typographia I. N. Skorokhodora. 1906.

The author travelled over the steppes of Russian Central Asia in the years 1902 to 1905, and contributed these papers, detailing the results of his investigations, to the annual of the Russian Geological and Mineralogical Society. The climate of the steppe is similar to that of the sandy deserts, but the extremes are less marked. The rainfall is three or four times as great, amounting on the grass steppe to about $5\frac{1}{2}$ inches, and the cloudiness is also much larger. The range of temperature of the air does not differ materially in the two regions, but the range of temperature on the soil is especially large in the deserts. The prevailing north and north-west winds increase in violence towards the south. Hence the character of the denudation differs in the steppes and in the desert. In the former, where the precipitation is greater, erosion plays a more important part, especially where elevations—even those of no great height—arrest some of the scanty moisture of the air, while in the deserts isolation and deflation are the predominating agents, and there are fewer obstacles to the formation of sandhills and *barkhans*. M. Ivchenko gives a very minute description of the various forms of denudation in different parts of the steppe and their relation to the climate and geology. He includes also some notes on the flora and fauna.

In the concluding chapters M. Ivchenko asserts that the prime cause of the formation of deserts and steppes is the form of relief—a basin, isolated or more or less open to the sea—and that climate and other agencies are of secondary importance. This seems a strange theory. The first essential for the existence of deserts and steppes is a small rainfall and excessive isolation owing to the absence of clouds, and these depend on the distribution of land and water and the consequent circulation of the atmosphere. Russian Central Asia is exposed to the dry north-westerly winds, while the monsoons of the Indian ocean are diverted by the huge elevated mass of the Himalayas. The Amazons basin, with its outlet towards the rain-bearing winds of the Atlantic, is abundantly watered, while German South-West Africa, rising directly from the ocean, is the driest part of West Africa south of the Sahara.

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conquering race had come from some Central African home wherein had been developed at much the same period, and also under Nilotic or Hamitic influence, the Bantu language type and the Bantu civilization, which was to overspread the southern half of Africa to Natal, to Zanzibar, and to the Congo.

GENERAL.

Economic Statistics.

'Die Weltwirtschaft: Ein Jahr-und Lesebuch.' Edited by E. von Halle. Three parts. Leipzig and Berlin. 1906.

The three parts or volumes (for they are separately paged) published under this title form the first year's issue of what is intended to be an annual publication, giving statistical and other data bearing on the economic condition of the principal countries of the world. The first part gives international surveys on economic policy, social policy, the production of food-stuffs and raw materials, the money market of the world, commerce, the means of communication, insurance, etc. The corresponding part of the second year is already issued. The second part is entirely devoted to Germany, and the third deals with other countries separately. In each part the different chapters are by specialists. Much of the information contained in these volumes will be of great use to geographers, though the work is mainly designed for economists and statisticians, no attempt being made in the work itself to deal with the facts contained in it from a geographical point of view. How far that point of view is from the minds of the writers may be judged from the fact that even in the volume on Germany there is no systematic statement of the localities in which different industries are carried on. Thus under "jute" there is not the slightest hint as to the principal seat or seats of this industry in Germany; under "linen" there is only an incidental mention of a wages agitation in the Berlin and Bielefeld districts; under "cotton" only an enumeration of spindles and looms by political divisions (states and provinces), and so in other cases.

G. G. C.

A Geographical Dictionary.

A. Demangeon, 'Dictionnaire de Géographie.' Paris: Amand Colin. 1907. *Price, 6 francs.*

This compact volume, composed of 860 pages of small type, or rather types, in double columns, is for the most part a general gazetteer; but over and above that is a dictionary of persons distinguished in connection with geography, and one of terms used in every branch of geography, including not merely definitions of terms, but brief expository statements. The scope of the work under this latter head may be indicated by mentioning that it contains brief articles under *aberration* (of light), *abîme*, *ablation glaciare* (in the sense of the melting of glaciers), *abyssal*, *acacia*, *acadien* (in geology), *acclimatation*, *altération* (dealing with changes in rock structure due to the action of water, air, sun-heat, frost, etc.), *altitude* (with an account of its influences on atmospheric pressure, on temperature, and on precipitation), *alumine*, *aluminium*, *alun*, etc. All the headings belong to one alphabetical arrangement. There are numerous sketch-maps and other illustrations. Oversights of one kind or another of course occur, but the work appears to be on the whole well done, and is likely to be very useful.

G. G. C.

Geographical Terms.

Lucien Hochsteyn, 'Les Termes de Géographie dans les langues du globe. Brussels Misch et Thron. 1907.

One cannot but regret the large amount of labour that has been almost entirely wasted in the preparation of this volume, at any rate in the form in which it is now published. The terms of geography are arranged in alphabetical order in the French language only, and there is no means of finding the meaning of a term in

any other language unless by the merest chance one drops on the required entry amongst thousands of others. Under *colline*, for example, one finds the equivalent in more than 150 languages, including the Taungtha, Welaung, Esperanto, etc.; but if one meets with the Taungtha name for "a hill," there is no index to aid one in learning the signification from this book. Moreover, if one may judge from the English equivalents that are given for the French terms, one cannot but be doubtful as to the accuracy of the equivalents in other languages. The English equivalents given for *colline* are exactly as follows: "cashion-shaped, doune, down, hill, hillock, hummock, knock, knoll, knowl, neck, meal, and slope." In some cases the foreign equivalent appears to have been arrived at by a very reckless use of dictionaries. Thus, for *croupe*, which is defined as "*le sommet arrondi d'une montagne*," the English equivalent *crupper* is given, which is indeed the equivalent for that meaning of the term *croupe* which has suggested the geographical sense, but which has no such geographical use in English. A more extraordinary instance is found under *albarède*, which is defined as a "*plantation d'aubiers*" (guelder-rose trees), and for which the English equivalent "bleak district" is given. This seems to have been arrived at in this way: The ordinary meaning of *aubier* is "alburnum," or "sapwood," for which an old and little used term is "blea" and perhaps "bleak." "Bleak," at least, is given in French if not in English dictionaries in that sense, and the author has added "district." There would, at least, be some value in the book if it were a complete list of French geographical terms with their meanings; but this it is not. The author appears to have understood "geographical terms" in a peculiar sense, which makes it difficult to understand his criterion for admission and inclusion of terms. *Bataille*, *bleu*, and other names of colours, the names of plantations of different kinds of trees are all included; but such terms as *atmosphère*, *cumulus*, and other names of cloud forms, *faille*, and other geological terms, are excluded. *Alluvion* and *limon* are both entered and defined, but there is no entry of *falun* (a deposit of sea-sand and sea-shells), a term much more likely to be sought for by those who consult a dictionary of this sort.

G. G. C.

SHORT NOTICES.

Asia.—'The Truce in the East and its Aftermath.' By B. L. Putnam Weale. (London: Macmillan. 1907. Pp. xv. and 645. *Maps and Illustrations.*) This is another of the political studies through which Mr. Weale's pen is well known; it is, in fact, a sequel to his 'Reshaping of the Far East.' The book is in the main a political prophecy; from the strictly geographical standpoint, it may be mentioned that the author maintains his policy of furnishing a few descriptive paragraphs (such as that dealing with a journey along the military railway in Korea), which undoubtedly add intelligibility to the work at large. The large map of the Far East must have undergone considerable revision in its time, but it would bear some more. The sketch-map showing the boundary between the "zones into which Manchuria is now tacitly divided" is interesting.

Africa.—'The Egypt of the Future,' by Edward Dicey (London: Heinemann. 1907. Pp. 216), is another political prophecy and sequel to a previous work—not, as in the case of the book just noticed, lightened by geographical description. The author contrasts Lord Cromer's system of government in Egypt with his own ideal.

America.—'Recent Hunting Trips in British North America.' By F. C. Selous. (London: Witeresby. 1907. Pp. 400. *Illustrations.*) The famous African sportsman here describes his hunting expeditions into new fields—Central

Canada, the district of the upper Yukon, and Newfoundland. There are among the photographs a few admirable landscapes.

'Four Centuries of the Panama Canal.' By Willis Fletcher Johnson. (London: Cassell. 1906. Pp. xxi. and 461. *Maps and Illustrations.*) The author certainly begins at the beginning. The title mentions four centuries, but at p. 7 we have a map—no more successful than most American cartography—of the world according to Ptolemy. But it is an interesting and well-told story, given with full and circumstantial detail, and the importance and value of such a history may increase as the work on the canal progresses. There are abundant incidental notes on the character and resources of the Isthmian region.

'Notes upon the Island of Dominica.' By Symington Grieve. (London: Block. 1906. Pp. 126. *Map and Illustrations.*) This account of Dominica is written mainly from the point of view of intending settlers, but with a liberal interpretation of their interests, so that it forms a useful general work of reference on the island.

Historical.—'Voyages of the Elizabethan Seamen.' Edited by E. J. Payne, with additional notes by C. Raymond Beazley (Oxford: Clarendon Press. 1907. Pp. lxii. and 415. *Maps and Illustrations*). This excellently produced handbook contains annotated narratives of voyages of Hawkins, Frobisher, Drake, Gilbert, and others, adapted from the originals, together with an introduction surveying the circumstances under which these voyages were undertaken, and the life and works of Hakluyt. One of the maps (North America, Greenland, etc.) is taken from Hakluyt, and the whole book is well calculated to present these pages of history in their proper atmospheres.

'A Sea-Dog of Devon,' by R. A. J. Walling (London: Cassell. 1907. Pp. xii. and 288. *Frontispiece*), is a clear narrative of the life of Sir John Hawkins, which fills a gap in books of this kind. If the author's many colloquialisms do not always command admiration, at least the whole spirit of the story tends to justify them. Mr. Walling is devoted to his subject, and inspires his reader also. The half-tone from an original family portrait of Hawkins is worth notice.

'The Real Sir Richard Burton.' By Walter Phelps Dodge (London: Fisher Unwin. 1907. Pp. 240. *Frontispiece*). This biography enters into the study of a remarkable character (or rather two, for Lady Burton figures largely) with intimacy. The book is readable, though it gives an impression of sketchiness, perhaps owing to the extensive use of very brief paragraphs. Some of the spellings of place-names may be thought needlessly unfamiliar—the "Neilgherries," for instance; and it is hardly fair treatment of an early geographical discovery to say that Burton, on sighting Tanganyika, was tempted to shout, *Thalatta, Thalatta!* "like Xenophon."

'The British Army under Wellington, 1813–1814,' by T. Miller Maguire (London: Clowes. 1907. Pp. 50), is a reproduction of articles in the *United Service Magazine*, embodying lengthy extracts from Wellington's 'Despatches,' and illustrated by several valuable maps.

General.—'L'Or dans le Monde,' by L. de Launay (Paris: Armand Colin. 1907. Pp. xxi. and 265), is a useful synopsis of the problems connected with gold—its geological occurrence and geographical distribution, the methods of its extraction, and the economic status of the metal.

'Imperial Outposts,' by Colonel A. M. Murray (London: John Murray. 1907. Pp. xxiv. and 210. *Maps and Illustrations*), is a fine study of the place in imperial geography and strategy occupied by such ports as Gibraltar, Aden, Singapore, Hong-Kong, and Vancouver. In the sub-title reference is especially made to the Japanese alliance, and four chapters are devoted to Japan. If imperial geography

were a subject within the view of the public at large, the book would be widely read: it should at least help to make it so. The author writes from personal knowledge gained in a journey which carried him round the world, so that the numerous excellent descriptions are at first hand. The maps are rough, and in most cases add little if anything to the text.

THE MONTHLY RECORD.

EUROPE.

Geography of the Temporary Settlements in the Alps.—The aims and methods of research in regard to these settlements are the subject of an article by Dr. R. Sieger in the *Geographische Zeitschrift* (vol. **30**, No. 7). The author points out that temporary settlements are not confined to grazing in the higher Alps. The inhabitants of Eifisch valley, *e.g.*, are called not only up to the heights to tend their cattle, but also down to the Rhone valley to tend their vineyards. Temporary settlements belong mostly, however, to a continuous mountain chain defined not altogether by isohypses nor by climatic limits, but also by economic needs. A pastoral region may be in part left unoccupied because not all needed. Or it may be inadequate, causing a depression or even effacement of the forest region. The need for wood accounts for the maintenance of forest patches alongside the pasture. The problem involves the consideration whether a settlement is occupied by only those actually employed, by whole families, or a whole village; whether a pasturage for sheep, for young or milkless cattle; whether occupied, as in the Italian Alps, by the owner and his family half the year. Account must be taken of the number and kind of settlements and buildings; the *personnel* and cattle; the distance of the lower Alps utilized in spring and autumn from the high Alps, and of both from the homestead; the ways to and fro; the paths up the Alps as important ways of communication in the past; the antiquity of the huts, the form and construction of which are often of interest in the history of domestication. The question of ownership, including not only private and communal, but also "common possession," calls for an adjustment of anomalies, which has stimulated the demand, especially in Austria, for statistical information. Statistics of a comprehensive or connected character exist only for Switzerland. The Tirol, and Carinthia, comprehending a wide variety of categories, and provided with descriptive matter, based more or less on a cadastral survey, much of which is valuable geographically. The paper includes a discussion of methods of geographical inquiry. Resolutions were carried at the Nürnberg *Geographentag*, at which the paper was read on May 23 last, affirming the importance of such investigation, greeting the efforts hitherto made in different parts towards a statistical record, and declaring the desirability of having similar registers drawn up for the whole of the Alpine lands, and of having the original material of these registers published as widely as possible.

ASIA.

Great Britain and Russia in Asia.—The convention signed at St. Petersburg on August 31, 1907, by Sir A. Nicholson and the Russian minister of foreign affairs, M. A. Iswolski, deals with various questions respecting the respective territories and spheres of influence in Asia—questions which have been at issue, either actually or potentially, between the two Powers for a number of years. Most of these are now definitively settled by the recent agreement, and it is to be hoped that it will enable the two nations to pursue their respective paths in the Asiatic continent without fear of mutual friction or complications. In some respects the part of the convention relating to Persia is of the most importance.

The two governments, while pledging themselves to respect the independence of that country, have come to an agreement respecting the portions of its territory which are in future to be reserved, respectively, for the exercise of British and Russian influence. The accompanying sketch-map indicates the lines by which these areas are bounded. Great Britain engages "not to seek for herself and not to

SKETCH-MAP ILLUSTRATING THE CONVENTION BETWEEN GREAT BRITAIN AND RUSSIA IN REGARD TO PERSIA. - - - - BOUNDARIES OF ZONES DEFINED BY THE CONVENTION.

support in favour of British subjects, or of the subjects of third Powers, any concessions of a political or commercial nature—such as concessions for railways, banks, telegraphs, roads, transport, insurance, etc.—beyond a line starting from Kasr-i-Shirin, passing through Isfahan, Yezd, Kakhk, and ending at a point on the Persian frontier at the intersection of the Russian and Afghan frontiers;" and

also pledges herself not to oppose demands for similar concessions supported by the Russian Government. A precisely similar undertaking is given by Russia with regard to the south-east portion of Persia, "beyond a line going from the Afghan frontier [precise point not specified *] by way of Gazik, Birjand, Kerman, and ending at Bunder Abbas." The places mentioned are, in each case, to be included in the area they are used to define. A separate section concerns Afghanistan, and in this Great Britain declares that she has no intention of changing the political status of that country, or of interfering in its internal government, provided that the Amir fulfils the engagements already contracted by him in the treaty of 1905. The Russian Government, on the other hand, recognizes Afghanistan as outside the sphere of Russian influence, and undertakes to conduct all their political relations with that country through the intermediary of the British Government. The last part of the convention has to do with Tibet. Both powers engage to respect the territorial integrity of that country, and to abstain from all interference in its internal administration. They also recognize the Chinese suzerainty over Tibet, and engage not to enter into negotiations with it except through the Chinese Government, nor to send representatives to Lhasa. The provisions of the convention of 1904 relating to commercial intercourse beeween Great Britain and Tibet still, however, hold good; but apart from this, the two countries are placed on a footing of absolute equality. By an exchange of notes between the plenipotentiaries on the date of the convention, the two Powers record their sense of the undesirability of the entry of any scientific mission into the country for a period of three years. It will be seen that in every case the result of the convention is a virtual recognition of the *status quo*.

Dr. Sven Hedin's Expedition.—From a letter written by Dr. Sven Hedin from Mansarowar lake on July 25, 1907, the substance of which is printed in the *Pioneer Mail* of Allahabad for September 20, it is evident that the explorer has accomplished a further piece of excellent geographical work since he was heard of from Shigatse early in the year. Although both the terminal points of his route—Shigatse and Tokchen on the Mansarowar lake—coincided with those of Major Ryder and Captain Rawling on their march up the valley of the upper Sanpo, he was able, by constantly deviating to the right and left, to avoid known ground almost entirely, the "Tasam," or high-road used in the main by the British surveyors, being followed for two and a half days only out of a total of eighty-one and a half days. In this way he increased the distance from 510 to 756 miles. The following is an extract from his letter: "To begin with, I followed the northern bank of the Tsanpo (Brahmaputra), then the Ragha-Tsanpo; left it again, and went to the north-west, my wish being to reach Dangra-yum-tso. So I had once more an opportunity to cross the gigantic mountain range, which is a watershed between the Brahmaputra and the self-contained lakes in the heart of Tibet. I crossed it now by the pass Chang-lung-podla. I camped at the eastern foot of Targu-ganpi, one of the most magnificent snow-mountains I have ever seen in Tibet, and, like Kailas (or Gang-rimotche), regarded as holy by the Tibetans, and I was within sight of Dangra-yum-tso, when fifty men, cavalry, stopped me, and told me I could go wherever I liked, only not to the holy lake. So I returned to the south-west, to the source of the Ragha-Tsanpo. The map hereabout is nothing like the reality. Nain Singh's Mun-tso is situated, not south, but

* The beginning of the line is omitted from our map (which must be taken as provisional only), as it is not clear whether or no it starts from the same point as that defining the zone reserved for Russian undertakings.

west of Dangra-yum-tso*; but south-south-west of the last there is a very big lake, Shuru-tso. To the south-west of this there is a high snow-range, which is a ramification from the head range. This last I crossed once again, for the third time, by the Angden-la, and then reached Amchok-tso, which I sounded all over. I was not able to cross and measure Shuru-tso, as the ice was just breaking up." Dr. Hedin says that the Ragha-Tsanpo, where it joins the Brahmaputra, is called Dok-chu, and is the largest tributary above Shigatse. From the confluence he went north-west again for five days, and then south to the junction of the Chata Tsanpo with the main stream. On arriving at Saka-dzong, whither he had sent the main caravan direct, he found that his caravan-leader, Mahomed Isa, who had acted in the same capacity for all the most important expeditions to Tibet from that of Carey onwards, had had a stroke of apoplexy, and, to the grief of all, he died that evening. Continuing to diverge constantly from the Tasam, Dr. Hedin reached the sources of the Kub in three great glaciers, whose enormous moraines cover the country all round. The snowy range which feeds them is called Rubi Gangri. Besides his usual meteorological and survey work, the traveller made constant measurements of the size of the rivers, and examined a number of monasteries. He speaks very highly of the work of his predecessors, Major Ryder and Captain Rawling, and of the excellent results of Sir F. Younghusband's mission, as evinced in the kindness and hospitality of the people.

The Volcano of Aso, in Kiu-shiu.—This great volcano, though briefly referred to in gazetteers and guide-books, is not often visited by travellers, so that the vivid description given by Mr. Robert Anderson in the *Popular Science Monthly* (July, 1907), on the basis of a recent visit, is worthy of attention. It is illustrated by a series of photographs which clearly bring out the remarkable features of the volcano and its surroundings. The most striking fact is the vast size of the ancient crater within which the present seat of activity is placed, its precipitous walls enclosing an area of at least 100 square miles, occupied by numerous villages whose inhabitants till the volcanic floor. Mr. Anderson claims for this crater the supremacy of all known volcanic craters in point of size, though curiously enough, the same claim has been made almost simultaneously for one of the old volcanoes of East Africa by the German traveller, Dr. Fritz Jaeger (see below, p. 562). The floor is divided into two crescent-shaped portions by the range of Aso, composed of several distinct summits, the most imposing being Neko-dake, the summit of which forms a jagged battlement of lava pinnacles. The higher summit of Taka-dake rises about 4000 feet above the crater floor. The modern crater, from which steam constantly escapes, lies on a low part of the range, its cone rising from an almost level upland strewn with mounds of volcanic *débris*. Standing at the brink, the traveller looks down walls of roughly stratified mud to a depth of 300 or 400 feet. The crater is oval in shape and divided into five compartments, or vents, only two of which are active. Severe eruptions have occurred within recent times, in 1873–74, 1884, 1889, and 1894. From the regularity of the outer slopes of the walls of the great crater, it seems likely that they represent the tuncated base of an old conical mountain, the summit of which has since been removed, either by some cataclysmic explosion, or by sinking of the central mass. Mr. Anderson, who calculates that the volume of the material removed must have been at least 28 cubic miles, or two and a half times that of a mountain like Vesuvius, inclines to the latter as the more probable mode of action. The range which now traverses the crater seems to be a later formation.

Researches in Sumatra. — The German traveller, Dr. Alfred Maass, well known for former scientific work in Sumatra, has lately undertaken a new journey

* It is only fair to the Pundit to state that his Mun Cho lakes were inserted from hearsay only, as they lay at a considerable distance from his route.

into the central portion of that island. Details of his movements have been given from time to time in the *Zeitschrift* of the Berlin Geographical Society. From the seventh issue for the present year we learn that, starting from Taluk, he has reached Gunung Sahilan, a centre of population on the left bank of the Kampar Kiri. The people of this region, who seem to present affinities with the inhabitants of Menang Kabau, made a favourable impression on the traveller, though both they and their country are poor. Herr Maass proposed to return to the coast at the end of July, thus completing a traverse of Central Sumatra from Padang to Siak.

AFRICA.

Journeys in the French Sahara.—The activity with which the French are pushing forward the consolidation of their influence in the Central Sahara receives a fresh illustration from the journey of Captain Arnaud, who, as is announced in the August number of the *Bulletin du Comité de l'Afrique française*, has lately made a journey across the whole of that region from Algeria to the coast of Dahome at Kotonu. During the first part of the route he was accompanied by Lieut. Cortier, while, after traversing the Hoggar region (in part by new routes), a junction was effected with detachments from the Sudan which had also covered some new ground. Subsequently, Lieut. Cortier remained in the "Adrar of the Iforas" for the purpose of completing a map of the whole mountainous region between the Algerian Sahara and the Niger; while Captain Arnaud, accompanied by Captain Pasquier, proceeded to the Niger at Gao, and thence, partly by river, partly overland, continued his journey to the coast. The whole journey occupied 127 days, and of a total itinerary of 3200 miles, 750 were over new ground. The same *Bulletin* reports that a successful reconnaissance into Borku has been made by Captain Bordeaux.

Dr. Jaeger's Journey in East Africa.—Dr. Jaeger and his companion, Herr Oehler, whose scientific researches in German East Africa were referred to in the *Journal* for April last (p. 459), returned to Europe early in the summer after completing a detailed examination of the interesting region between Kilimanjaro and the Victoria Nyanza. Extracts from Dr. Jaeger's letters describing the journey and its results have been printed in the *Mitteilungen aus den Deutschen Schutzgebieten* (1907, Nos. 2 and 3). The routes followed formed a particularly close network over the area lying between lakes Manyara and Eiasi and between the parallels of $2\frac{1}{2}°$ and $4\frac{1}{2}°$ S., the features of which have thus been subjected to a fairly complete investigation. They exhibit considerable variety, as stretches of upland or groups of hills alternate with rift-valleys bounded by steep walls, while a number of old volcanoes and craters offer a special object of study. Dr. Jaeger speaks enthusiastically of the district of Iraku, south-west of Manyara, which had been the scene of disturbances before his visit, but had just been successfully opened up. He was struck with the freshness of the air, the greenness of the cultivated areas, and the abundance of running water—advantages none too common in this part of Africa. He also speaks favourably of the inhabitants, who are a fine race, with little of the negro in their composition. Visits were paid to Lake Eiasi and to the small lake or swamp known as Hohenlohe, which proved to have *fresh* water, and to be much nearer the larger lake than had been supposed. Mount Gurui was also ascended. It is a volcanic cone of lava, breached by a caldera due to explosion on the north-east, as well as by a central caldera mainly the result of erosion, the slopes being also much seamed by ravines. Some difficulty was occasioned by want of water, and it was necessary to proceed to Mwanza on the Victoria lake in order to refit. Work was resumed after the rains had set in, a more northerly part of the country being now visited. Striking east through the southern part of

Ndasekera—a mountain land falling in escarpments to the east, west, and south—the travellers reached Ngorongoro, to which district and the little-known volcanoes which surround it special attention was devoted. It forms in itself a depression which Dr. Jaeger regards as an old crater, over 12 miles across, possibly the largest known anywhere.* The whole region is likened by Dr. Jaeger to the Phlegræan fields on a far vaster scale, the peaks reaching heights of 10,000 to 13,000 feet, while apart from Ngorongoro itself, other craters reach a diameter of 2 or 3 miles. Two of the principal peaks are Deani and Lemagrut (Lerobi and Lmagro of existing maps), which together nearly block the rift-valley of Lake Eiasi. Deani has a height of 10,500 feet, and its huge caldera is perhaps nearly 3 miles across. Both the crater and the outer slopes are in great part clothed with primeval forest—at higher levels with bamboos. Lemagrut consists of a "Somma" and a deeply furrowed central cone, without a crater. Its lava has united with that of Deani to form an upland with an elevation of over 8000 feet. Another interesting volcano is Elaneirobi, whose crater—nearly 5 miles across—has its walls clothed in forest, and a salt lake in its centre. The rainy season interfered considerably with Dr. Jaeger's plane-table work, but data for a fairly complete map were obtained. His companion was forced by fever to leave him, but has since quite recovered.

Expeditions in Central Africa.—We learn from the *Zeitschrift* of the Berlin Geographical Society that the well-known ethnologist, Leo Frobenius, has just started on a new research expedition into Central Africa. He has with him Dr. Hugersoff in the capacity of geodesist and geologist, and Herr Fritz Nansen as artist and photographer. He will proceed through Senegal to the upper Niger and Timbuktu, whence he proposes to make an excursion within the bend of the Niger. The second year's work will, according to the explorer's present plans, be devoted to the region of the lower Niger, Togo, and, if possible, the Kamerun. Geographical and economic, as well as anthropological, researches are contemplated. An expedition for the study and mapping of the Kamerun range was to start in September under the leadership of Prof. Hassert, accompanied by Prof. Thorbecke (*Geogr. Zeits.*, 1907, No. 7), while a scientific expedition to Spanish Guinea is announced in *Petermanns Mitteilungen* as about to start from Lübeck, mainly for the purpose of zoological and ethnological collections. Its leader will be Herr Tessmann, who has already done work of the kind in the south of the Kamerun. The same periodical announces the return to the coast of Don Livio Caetani, a son of the Duke of Sermoneta, who has carried out a journey through the Galla countries of Guraghe and Walamo to Lake Rudolf, returning through Kaffa and Jimma.

Geology and Scenery in South Africa.—The connection between the surface features and geological structure of South Africa was clearly sketched by Dr. G. S. Corstorphine in his presidential address to the Geological Society of South Africa in January last, which has been printed in the *Proceedings* of that body for 1907 (pp. xix.–xxvii.). The speaker began by glancing at some of the general characteristics of the area in question, pointing out that, broadly speaking, the resemblances in the scenery are produced by the prevailing geological uniformity, while the differences are due to the variations in the climate. He then considered in detail the mountain belt, the coastal zone, and the interior plateau. In the mountain belt, consisting of true mountain chains with as much intricacy of structure as the Alps of Central Europe, a marked contrast is noticeable between the typical ranges of Cape Colony and such remnants as still exist in Natal, the valleys in the latter case being not structural valleys, but produced by the cutting out

* See, however, the account of Mount Aso in Kiu-shiu, on p. 560, *ante*. The ancient crater in which this is placed seems quite as large.

of great masses of the strata. The whole belt is essentially composed of quartzites, but whereas in the more arid parts of Cape Colony these produce a stern bare landscape, further east the moister climate renders vegetation abundant. Variation due to climatic differences acting on the same geological formations is again seen in the coastal zone, for while in the north-west the granite and schistose rocks form bare and low undulating hills, in the more humid east and north-east numerous rivers flow seaward in deeply cut valleys. The interior plateau shows a greater diversity, both of scenery and geological constitution. The horizontal sandstones and shales of the Karroo form a true denudation landscape, the flat-topped hills marking the earlier, the pointed ones the later, stages of disintegration. The change of scenery which occurs from about the centre of the Orange River Colony, northward into the Central Transvaal, coincides with the prevalence of softer, more felspathic, sandstones, producing, by their more regular weathering, the unbroken aspect of this region. Where the Karroo formations are pierced by basic igneous intrusions we find low ridges extending for miles across the country. In the Central Transvaal, which has been largely stripped of its covering of Karroo rocks, the characteristic type is that in which low but abrupt escarpments of quartzites, with dip-slopes inclining to the north or south, form one side of a valley carved out of the softer slates or shales. This is exemplified in the Gatsrand, Witwatersrand, and other east-to-west ridges. Further north the undulating landscape is due to the presence at the surface of a large extent of the old granite. Everywhere in South Africa denudation has played a preponderating *rôle*, and its intensity at the present day is largely due to the senseless destruction of the vegetable covering by the annual grass-burnings.

AMERICA.

Topography of Alaska.—The work of the U.S. Geological Survey in Alaska has hitherto been mainly concerned with districts likely to be of economic importance, and the areas mapped were often very irregular in outline. An attempt is now being made to provide a series of topographical maps of more uniform plan, and therefore of greater utility from a practical point of view. They will cover quadrangular areas bounded by parallels and meridians, as in the case of surveys within the United States proper, but in view of the less rigorous character of the work, the unit adopted will be larger, viz. a space of 4° of longitude by 2° of latitude. The first of these maps to be issued is that of the eastern portion of the area between the Yukon and Tanana rivers, and it accompanies a description of the quadrangle by Mr. L. M. Prindle, forming Bulletin No. 295 of the survey. It was within the Yukon-Tanana region, which has a total area of about 40,000 square miles, that discoveries of gold in 1886, 1893, and 1902 led to a rapid development of mining, particularly in the Fairbanks region north of the lower Tanana. The two main rivers form the chief routes of travel, the productive areas being reached from these either by overland trails, by tributaries navigable for small boats, or, in the case of the Fairbanks region, by railway and waggon road. The area is a part of the great dissected plateau-like region which stretches east and west through central Alaska, the most characteristic feature (apart from the lowlands on the two great rivers) being the constant repetition of ridges and valleys of fairly uniform height and depth, with occasional more sharply accentuated elevations, especially on the northern edge of the hill country. The drainage systems are strangely intermingled, and there is no well-defined divide between the waters tributary to the Yukon and Tanana. Benches are prominently developed at various levels along some of the streams, indicating changes of level in the past. The original surface being very uniform, the valleys at corresponding points are

developed to about the same depth and have about the same grade, this being usually low almost to the valley-heads, where the rise to the enclosing ridges is very steep. The temperature has an extremely wide range, and the long warm days of summer soon clothe with green luxuriance much of the deeply frozen surface. The great differentiation of the seasons naturally entails much change in modes of living and transportation methods. Spruce timber of large size occurs in the lower valleys of the largest streams, while small spruce (with birch and poplar) covers the lower ridges, the higher parts being mostly bare. The geology is complex, the rocks being chiefly metamorphic—the oldest, schists of probably pre-Devonian age. Besides gold, coal occurs in several localities.

Control of the Colorado River.—The engineering works undertaken for the purpose of confining the Colorado river within its proper bed at the point where it lately broke through its banks to flow into the Salton sea (*Journal*, vol. 29, p. 461) have at last accomplished their object. In a short communication printed in the July number of the *Popular Science Monthly*, Mr. C. A. Byers recounts the various unsuccessful efforts made to obtain control of the river, as well as the building of the dam which finally proved effectual for the purpose. The last of the previous efforts, which, though not itself successful, aided in the final capture, had resulted in the formation of a dam 35 feet high in places, and 3000 feet in length, of which 600 were of rock and the remainder of earth and gravel. The foundations consisted of a mat of willow and cable, held in place by strong piles. As many as 1100 men, 600 horses and mules, besides steam dredgers, shovels, pile-drivers, etc., were employed at one time. The break that occurred in this dam in December, 1906, was 1100 feet wide, but gigantic efforts were at once made to cope with it, and in the short space of thirteen days 100,000 tons of material were dumped into the gap, much of it brought from over 300 miles away. It was practically completed on February 10, but the work of embankment is still being actively carried on, and there will eventually be 16 miles of levee along the west bank of the river. The cost has already exceeded three and a half million dollars. The conditions in the region overflowed by the river have been studied by Dr. MacDougal on behalf of the Desert Laboratory of the Carnegie Institution. From the *Geographische Zeitschrift* (1907, No. 7), we learn that a good deal of water continues to percolate into the Salton lake, so that it is not likely to dry up immediately. In February last it covered an area of 700 square miles. Cultivation of the areas now left dry has already been begun.

Flora of the Florida Sand Keys.—A thorough botanical examination of the small sandy islets lying to the west of Key West, Florida, was made in 1904 by Mr. O. S. Lancing, junior, under the auspices of the Field Columbian Museum. The results are recorded in a paper by Mr. C. F. Millspaugh, forming Publication 118 of that Museum, issued at Chicago in February, 1907. With one or two unimportant exceptions, the flora of all the keys examined is shown by means of sketch-maps, on which the location and extension of the various species are represented by arbitrary signs, the same sign being always used for the same species. Generally speaking, the vegetation of the keys consists of the usual strand species (mangroves, etc.), found in similar situations throughout the Antillean islands But various special points are brought out by the detailed distribution of the species, which are of interest to the student of the subject of plant dissemination in general. Thus, while the mangroves and avicennias usually occur in close association, on the small Ballast key, they were found disposed at the greatest possible distances apart, and two isolated colonies of *Uniola* and *Euphorbia* were noticed on the same islet, though growing elsewhere in association. A remarkable isolation of individual colonies was elsewhere found to exist, and seemed only explicable on the supposition

of the youth of the area on which they occurred. On the narrow sand-ridge of Man key, the main elements of the flora, seven in number, displayed a remarkable arrangement in clear-cut zones, such as was observed nowhere else in the archipelago. On the other hand, Key C of the Marquesas group, though only ⅜ mile in diameter and barely 2 feet above the sea at its highest point, showed a large number of diverse species mixed without definite association character, although the greater part is entirely occupied by a mangrove colony. The number of species occurring in so small a space is attributed to the probable resort of aquatic birds. Mr. Millspaugh points out that this careful survey, besides permitting any future changes in the flora to be traced, will be of value as throwing light on the species which come first to such microcosms, thus pointing to the ease or difficulty of dispersion exhibited by certain species; and also on the manner in which species spread when brought into an untainted environment.

AUSTRALASIA AND PACIFIC ISLANDS.

Journey across Western Australia.—After remaining at Flora valley, in the Kimberley division of Western Australia, through the wet season from October to February last, Mr. A. W. Canning, of whose expedition across the desert country between the East Murchison and Kimberley goldfields an account appeared in the June *Journal* (vol. **29**, p. 678), started on the return journey and arrived back at Wiluna at the beginning of July, thirteen months after his departure from that place. The journey south confirmed the favourable impression Mr. Canning had derived from the northward march as to the practicability of establishing a stock-route between the pasture lands of the Kimberley division and the markets of the eastern goldfields. The tropical rains were found to have reached about halfway across the desert, and in the neighbourhood of Godfrey's Tank the country presented a remarkably fresh, green appearance. There is some poor country round Separation Well, but this is avoided by the route which Mr. Canning has marked out. Kangaroos and emus were scarce in the country traversed, but the expedition came across numbers of what Mr. Canning describes as "miniature dogs no larger than rats," which are killed by the natives for food. On the whole the natives were again friendly and willing to point out water-holes, though one of the members of the party was speared. From the observations of the expedition, it appears that kindred tribes of aborigines extend latitudinally rather than longitudinally, the dialects changing more rapidly from north to south than from east to west.

POLAR REGIONS.

Dr. Bruce's Expedition to Spitsbergen.—Particulars are now available of the work accomplished during the past summer in Prince Charles Foreland by the Scottish expedition under Dr. W. S. Bruce, brief allusion to which was made in the October number of the *Journal*. Last year a similar expedition under Dr. Bruce, acting in conjunction with the Prince of Monaco, landed on the north-eastern shores of Prince Charles Foreland, and surveyed a considerable portion of the island. In continuation of this work a base camp was established last June on the south-west coast, and several weeks were spent in a survey of the neighbouring country. Brief excursions were also undertaken farther afield, including a cruise up Ice fjord, the great indent in the western shores of the main island of the Spitsbergen group. Early in August Dr. Bruce and two other members of the expedition proceeded northwards, and it was during their absence that Captain Isachsen, acting on behalf of the Prince of Monaco, arrived at the base camp. It was arranged by messenger with Dr. Bruce that the latter should round the northern end of the Foreland and return south along the east coast, where Captain Isachsen was to be

ready to take the explorers on board. The weather conditions, however, prevented the execution of this programme. Unable to round the northern end of the island, Dr. Bruce had to return by the west coast; hence his failure to arrive when expected on the east coast, and hence the fears that were excited as to the safety of the explorers. Throughout the expedition the weather was of an exceptionally trying character; but Dr. Bruce denies that he and his companions were ever in any danger, and repudiates all reports of sensational experiences. As a result of the two years' work in the Foreland, a detailed chart has been obtained of the whole of the west coast on a scale of 2 inches to the mile; the mountainous interior has been similarly surveyed, as well as a considerable portion of the east coast. Specimens of rocks and fossils, some of the latter of which appear to date back before the Tertiary age, promise to throw interesting light on the geological history and formation of the island; and extensive collections of plants and birds have been formed, including several species not previously known to exist in the Spitsbergen group. Dr. Bruce describes Prince Charles Foreland, which has an average length of 55 miles and an average breadth of about 6 miles, as divided into three regions. Hilly country extends for 5 or 6 miles from the southern extremity; for another 14 miles extends low-lying country, nowhere more than 60 feet above sea-level; while the northern two-thirds of the island comprise an almost continuous range of mountains, the highest peaks of which rise to heights of nearly 4000 feet. The Foreland was crossed by the expedition in several places. The mountains are much glaciated, some of the glaciers on the east coast (but not on the west) descending to sea-level. An extensive series of terraced beaches was found to exist between the foot of the mountains and the sea. Dr. Bruce reports that Captain Johansen, Dr. Nansen's companion on the journey from the *Fram* across the North Polar basin, is spending the winter in the north-west of Spitsbergen.

The Duke of Orleans' Expedition to Novaya Zemlya and the Kara Sea.—The success met with by the Duke of Orleans in his expedition to East Greenland in 1905 encouraged him to undertake a new voyage to the polar seas during the past summer. This time the region around Novaya Zemlya was chosen as the field for research, the *Belgica* being again in command of Captain de Gerlache, while several scientific men, including Dr. Recamier, who took part in the former voyage, sailed in the ship, which left Vardo on July 9. The expedition returned to Hammerfest on September 15, the duke arriving in England on September 30, accompanied by Dr. Recamier. A short account communicated to the press states that the *Belgica* passed through Matochkin Shar on July 14, but was soon afterwards beset by heavy ice, from which she was not liberated till August 21. During this time the ship was drifted from the Kara into the Barents sea by north-east winds. The party explored the west coast of Novaya Zemlya, but work was somewhat hampered through the ship grounding on an unknown shoal, which rendered it necessary to lighten her by throwing part of the coal overboard. Nevertheless, the coast of Novaya Zemlya was followed up to 78° N. Valuable scientific observations are said to have been secured. The duke has consented to give the Society an account of the voyage during the approaching session.

The Danish Scientific Station in Greenland.—We learn from the *Geogr. Zeitschrift*, 1907, No. 6, that a first report has been received from the director of this station (*Journal*, vol. 27, p. 408), Mr. M. P. Porsild. The site chosen for the station was Angakudsarrik, in Österdalen, east of Godhavn, a spot well sheltered from the north winds. Winter set in with heavy snowfalls in September, but the work at the station was not thereby interrupted. The library of over 3000 volumes was opened at Christmas, and the laboratory was ready for use by February. The winter was unusually severe even for this high latitude, the snowfall being

exceedingly heavy, while a temperature of 27° below zero Fahrenheit was registered. The work on the station proved a godsend to the people of Godhavn, for whom no relief measures were necessary during the winter.

The Area of Greenland has been calculated by Mr. H. Prytz, who gives the result in the latest issue of the *Meddelelser om Grønland* (No. 33). It comes out as 2,143,200 square kilometres, which is equivalent to 826,500 square miles. The areas of different sections of the country are also given, that of the ice-sheet being placed at 1,848,400 square kilometres, or 712,750 square miles, while the settled districts of the west coast amount to only 116,000 square kilometres, or 43,130 square miles.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Deficiency of Mass under Mountain Ranges.—That such a deficiency exists has been shown in the case of various ranges by the results of pendulum observations. It has been supposed by some that this is due to the presence in the Earth's crust, beneath the ranges, of rocks of unusually low specific gravity. This can hardly be considered a probable solution of the problem, and it seems preferable to suppose, according to a suggestion first put forward, apparently, by Prof. Heim, that the cause is to be found in the greater depth to which the ordinary components of the surface layers—rocks with an average specific gravity of about 2·5—reach in localities where such a deficiency of mass has been observed. The same explanation is supported by Herr K. Gugler in a paper, written without knowledge of Prof. Heim's suggestion, and lately printed in the *Vierteljahrsschrift des Naturforschenden Gesellschaft* (vol. **51**, 1906, pt. 2–3) at Zürich. This writer supposes that the surface crust, with a specific gravity of 2·5, is replaced at a comparatively small depth by heavier materials, such as iron ores and basic eruptive rocks with a specific gravity of about 5 (the central core being composed of still heavier materials, such as metallic iron). In order to obtain a quantitative test of the theory, he supposes definite lines of division (at arbitrarily-chosen depths) between the various layers, though recognizing that a progressive increase with the depth is more probable, and shows that the required "isostasy" is obtained by supposing either of the two upper layers to reach a greater thickness beneath mountain ranges than elsewhere. This would be quite consistent with the supposition that mountain formation is due to tangential thrust in the outer layers, due to shrinking of the core, for with diminution of area the crust must become correspondingly thicker, and the ridging up of portions would involve a sinking of the under surface of the crust in order to preserve equilibrium. The writer's supposition as to the relative specific gravities of the outer and inner layers of the crust (2·5 and 5) leads him to the result that the basal depression of the lighter of the two under a mountain range is the exact equivalent of the elevation of the range; but this would, of course, not hold good in any other case.

Icebergs near the Orkneys in 1836.—Dr. L. Mecking lately called attention to a statement of Dove, in an article on north polar currents published in 1854, that two large icebergs were sighted in 1836 by Sir James Ross, in the ship *Cove*, not far from the Orkney islands. He pointed out (*Zeitschrift Ges. Erdk. Berlin*, 1907, No. 3) that in the published accounts of the voyage (which was undertaken for the purpose of carrying assistance to a whaling-fleet in Baffin bay) no mention is made of such an occurrence, while negative evidence seemed also supplied by the general consensus of opinion on the part of writers on hydrography, that no icebergs had ever been seen on or near the British coasts. On the other hand, a letter from one of the officers of the *Cove*, printed in the *Nautical Magazine* for 1836, contained the statement, "We have been in company with icebergs," but with no indication of place or date. Dr. Mecking concluded that unless some more substantial evidence

was forthcoming, we must suspend judgment on the correctness of Dove's statement. The required evidence has since been obtained, for during a recent visit to this country, Prof. Krümmel, who had till then been sceptical as to the truth of the story, suggested to Captain C. Hepworth the examination of the original log of the voyage. The result, which Prof. Krümmel notes in the seventh number of the *Zeitschrift*, p. 473, is to fully confirm the statement, the log for the morning of January 14, 1836, recording the observation of two icebergs (size not mentioned) in 60° 55′ N., 5° 50′ W. The position is 40 nautical miles south-east of Suderö in the Færoes, and 130 miles north-west of the Orkneys, at the north-west corner of the Færoe-Shetland channel, with a depth of about 160 fathoms. The bergs, as Prof. Krümmel points out, must undoubtedly have been derived from the polar current which runs east of Iceland.

GENERAL.

The Centenary of the Geological Society was celebrated in London on September 26 and following days. On the morning of that day the president, Sir A. Geikie, received the delegates from foreign countries, scientific societies, and other bodies throughout the world, in the hall of the Institution of Civil Engineers. The Society was represented by Major C. F. Close, who presented an address of congratulation on behalf of the Council. In the afternoon of the same day Sir Archibald Geikie (to whom the medal of the Institution of Mining and Metallurgy had been presented in the morning by the representatives of that body) delivered an address of welcome to the delegates and other guests, and spoke of the progress made by geological science during the past century, and of the part taken in its development by the Geological Society. A dinner was held in the evening at the Hôtel Métropole.

International Seismological Association.—The first International Earthquake Conference held since the complete organization of this association took place at The Hague from September 21 to 25, under the presidency of Prof. L. Palazzo, Director of the Italian Meteorological Office. It may be remembered that the first conference of the kind was held at Strassburg in 1901, and that it led to the decision to work for the establishment of an association of states to be officially represented at future conferences. A first meeting of such official representatives was held at Strassburg in 1903, and led to the organization of the association on definite lines by the acceptance of a series of regulations, a full reprint of which will be found in *Petermanns Mitteilungen* for 1903 (p. 201). The central bureau of the association has since been inaugurated at Strassburg (*Journal*, vol. **28**, p. 81). The work of the recent conference had to do partly with the general administration of the association, and partly with the discussion of practical questions relating to its scientific work, which include the collection and correlation on a uniform system of earthquake observations made at various stations throughout the world, the preparation of a bibliography, the issue of an annual catalogue of earthquakes, and so forth. Among the minor points discussed were the establishment of a station at Kashgar, and the problem offered by the somewhat mysterious sound phenomena known as Barisal guns, Mistpoeffers, and by other names.

Were Dapper and Montanus one Individual?—That such was the case is laid down by Mr. R. R. Schuller in a pamphlet printed (without date) at Santiago in Chile. The original Dutch edition of the 'New and Unknown World,' printed at Amsterdam in 1671, appeared under the name of Arnold Montanus, while the German translation of 1673 was ascribed on the title to Dr. O. D., evidently Dapper. This has somewhat puzzled the bibliographers, including the acute and learned P. A.

Tiele ('Nederlandsche Bibliographie van Land- en Volkenkunde,' s.v. *Montanus*), who suggests that the two men formed a literary co-partnership. Mr. Schuller points to the privilege of the 1673 edition, in which the original Dutch work is definitely ascribed to Dapper, as proving his contention, and criticizes the bibliographers for not discovering the identity of the two authors. He states that no biography of Montanus is to be found, while notices of Dapper appear in all the great biographical dictionaries. The notice of Dapper by Eyriès, in the 'Biographie Universelle' (Michaud's) speaks, however, of Montanus as a distinct individual, and we are informed that a special notice of him appears in Van der Aa's 'Biographisch Wordenboek der Nederlanden.' The suggestion, therefore, cannot certainly be accepted.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are as a rule written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendes.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k.k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

France—Meurthe-et-Moselle. *C.R.A. Sc. Paris* **144** (1907): 586–589. **Nicklès and Joly.**
Sur la tectonique du nord de Meurthe-et-Moselle. Note de René Nicklès et Henry Joly. *With Sketch-map.*

Germany—Baltic Coast. *Annalen Hydrographie* **35** (1907): 113–122, 149–163. **Kaiser.**
Land- und Seewinde an der deutschen Ostseeküste. Von Max Kaiser. *With Charts and Diagrams.*

Germany—Bavaria. *Deutsche G. Blätter* **30** (1907): 24–30. **Breu.**
Neue Gewitterstudien an Oberbayrischen Seen. Von Georg Breu. *With Sketch-map.*

Discusses the cause of the frequency of storms in this region.

Germany—Bavaria. *Deutsche Rundschau f. G.* **29** (1906–7): 241–246. **Breu.**
Haben die Oberbayrischen Seen einen Einfluss auf die Gewitterbildung und auf den Gewitterverlauf? Von Georg Breu. *With Sketch-map and Diagram*

Germany—Ice Age. **Thienemann.**
X. Jahresber. G. Ges. Greifswald, 1905–6 (1907): 381–462.

Planaria Alpina auf Rügen und die Eiszeit. Von Dr. August Thienemann. *With Maps and Plate.*

Germany—Morphology. **Spethmann.**

Die Lübecker Mulde und ihre Terrassen. Ein Beitrag zur postglazialen Genetik des südwestlichen Ostseebeckens. Von Hans Spethmann. (Separat-Abdruck aus dem Centralblatt für Mineralogie, etc., 1907, No. 4.) Size 9 × 6, pp. 97–105.

Germany—Phytogeography. *Petermanns M.* **53** (1907): 25-36. **Höck.**

Versuch einer pflanzengeographischen Umgrenzung und Einteilung Norddeutschlands. Von Prof. Dr. F. Höck. *With Map.*

Germany—Pomerania. **Bellmer.**
X. Jahresber. G. Ges. Greifswald, 1905–6 (1907): 463–502.

Untersuchungen an Seen und Söllen Neuvorpommerns und Rügens. Von A. Bellmer. *With Maps and Sections.*

"Söllen" are small roundish depressions, filled either with water or peaty substances.

Germany—Pomerania. **Deecke.**
X. Jahresber. G. Ges. Greifswald, 1905–6 (1907): 43–60.

Vineta. Von W. Deecke. *With Sketch-map and Illustrations.*

The writer believes that the tradition of the sunken city of Vineta points to a sinking of the coast-line in the early middle ages, by which a group of dolmens or other burial-monuments was covered by the sea.

Germany—Posen. *X. Jahresber. G. Ges. Greifswald*, 1905–6 (1907): 351–380. **Lehmann.**

Wanderungen und Studien in Deutschlands grösstem binnenländischen Dünengebiet. Von F. W. Paul Lehmann. *With Sketch-maps and Diagrams.*

Germany—Prussia. *X. Jahresber. G. Ges. Greifswald*, 1905–6 (1907): 1–27. **Elbert.**

Die Landverluste an den Küsten Rügens und Hiddensees, ihre Ursachen und ihre Verhinderung. Von Dr. Joh. Elbert. *With Map.*

Germany—Prussia. *X. Jahresber. G. Ges. Greifswald*, 1905–6 (1907): 61–221. **Elbert.**

Die Entwickelung des Bodenreliefs von Vorpommern und Rugen, sowie den angrenzenden Gebieten der Uckermark und Mecklenbergs während der letzten diluvialen Vereisung. Von Dr. Johannes Elbert. Zweiter Teil. *With Map and Sections.*

Germany—Prussia. *Deutsche Erde* **6** (1907): 2–6. **Hahn.**

Die Entstehung der Bevölkerung Ostpreussens. Begleitworte zur Nationalitätenkarte von Ostpreussens. Von Prof. Dr. Friedrich Hahn. *With Map and Illustrations.*

Holland—Geology. *Ts. K. Nederland. Aardrijksk. Genoots.* **24** (1907): 129–166. **Baren.**

De morphologische bouw van het diluvium ten westen van den Ifsel. Door J. van Baren. *With Map and Illustrations.*

Italy—Capri. **Furchheim.**

Die Blaue Grotte auf Capri. Eine Monographie von F. Furchheim. Wien, 1907. Size 9½ × 6¼, pp. 12. *Illustrations.*

Italy—Capri. **Trower.**

The book of Capri. By Harold E. Trower. Naples: Emil Prass, 1906. Size 8½ × 5½, pp. xxviii. and 346. *Illustrations. Price 5 lire. Presented by the Author.*

An excellent handbook for visitors to the island.

Italy—Como. *Riv. G. Italiana* **14** (1907): 79-89. **Bianchi.**

Sulla distribuzione della popolazione nella provincia di Como. Studio del Dott. Franco Bianchi.

Italy—Historical. *Rendiconti R.A. Lincei* **15** (1906): 199-225. **Pais.**

Intorno all'estensione del nome degli Ausones e dell' Ausonia. Di Ettore Pais.

Italy—Sicily. *Riv. G. Italiana* **14** (1907): 1-15. **Almagià.**

Distribuzione della popolazione in Sicilia, secondo la constituzione geologica del suolo. Studio dell dott. Roberto Almagià.

Italy—Venetia. *Mem. G., Riv. G. Italiana* **1** (1907): 1-100. **Marinelli.**

Studi sopra i limiti altimetrici. I. I limiti altimetrici in Comelico. Ricerche di Olinto Marinelli. *With Maps and Illustrations.*

This forms the first part of a series of memoirs supplementing the *Rivista Geogr. Italiana.*

Norway. *G. Teacher* **4** (1907): 5–15. **Brigham.**
The Fiords of Norway. A study in human geography. By Prof. Albert Perry Brigham.

Pyrenees. **Briet.**
Les Pyrénées et la spéléologie. Par Lucien Briet. (Extrait du Bulletin Pyrénéen, No. 61. Janvier-Fevrier, 1907.) Size 9 × 6, pp. 10.

Pyrenees. **Stuart-Menteath.**
Pyrenean Geology. By P. W. Stuart-Menteath. Parts 6 and 7–8. London: Dulau & Co., 1906–7. Size 8½ × 5½, pp. (part 6) 38; (parts 7–8) 28. *Presented by the Author.*

Russia—Cartography. *M.G. Ges. Hamburg* **21** (1906): 1–61. **Michow.**
Das erste Jahrhundert russischer Kartographie 1525–1631 und die Originalkarte des Anton Wied von 1542. Von H. Michow. *With Facsimile Maps.*

Scandinavia—Glaciation. *Z. Ges. E. Berlin* (1907): 27–43, 87–101. **Werth.**
Studien zur glazialen Bodengestaltung in der skandinavischen Ländern. Von Dr. Emil Werth. *With Sketch-maps.*

Spain. **Rikli.**
Kultur- und Naturbilder von der spanischen Riviera. Von Dr. M. Rikli. (Neujahrsblatt der Naturforschenden Gesellschaft in Zürich auf das Jahr 1907; 109 Stück.) Zurich, 1907. Size 11 × 9, pp. 46. *Illustrations.*

Switzerland—Alps. **Heim.**
Vierteljahrschrift Naturfors. Ges. Zürich **51** (1906): 462–472.
Die Erscheinungen der Längszerreissung und Abquetschung am nordschweizerischen Alpenrand. Von Arnold Heim.

Switzerland—Historical. *Globus* **91** (1907): 159–160. **Mehlis.**
Das romische Grenzwehrsystem in der Nordschweiz. Von Dr. C. Mehlis. *With Sketch-map.*

United Kingdom—Cornwall. **Hill and MacAlister.**
Memoirs of the Geological Survey. England and Wales. Explanation of sheet 352. The Geology of Falmouth and Truro and of the mining district of Camborne and Redruth. By J. B. Hill and D. A. MacAlister. London, 1906. Size 10 × 6, pp. x. and 336. *Sketch-map and Illustrations.*

United Kingdom—Cornwall. **Reid and Scrivenor.**
Memoirs of the Geological Survey: England and Wales. The geology of the country near Newquay. By Clement Reid and J. B. Scrivenor. London, 1906. Size 9½ × 6, pp. iv. and 132. *Illustrations and Sketch-map.*

United Kingdom—England. *G. Teacher* **4** (1907): 29–38. **MacMunn.**
The economic historical geography of a county, illustrated from Essex and Cumberland. By Nora E. MacMunn.

United Kingdom—England—Coal. *J.S. Arts* **55** (1907): 450–460. **Dawkins.**
The discovery of the south-eastern coalfield. By Prof. W. Boyd Dawkins. *With Map and Section.*

United Kingdom—Ireland. *P.R. Irish A.* **26** (1907): B., 74–96. **Kilroe.**
The river Shannon: its present course and geological history. By J. R. Kilroe. *With Map and Sections.* (See p. 208, *ante.*)

United Kingdom—Ireland. **Lamplugh and others.**
Memoirs of the Geological Survey of Ireland. The geology of the country around Limerick. By G. W. Lamplugh and others. Dublin, 1907. Size 9½ × 6, pp. vi. and 120. *Maps and Illustrations.*

United Kingdom—London. *London Topographical Record* **4** (1907): 113–140. **Gomme.**
Catalogue of the exhibition of maps, views, and plans of London, exhibited at the conversazione held at Drapers' Hall on Thursday, March 16, 1905. By Bernard Gomme.

United Kingdom—London. *London Topographical Record* **4** (1907): 1–12. **Norman.**
Address by Philip Norman [on the Roman Wall of London]. *Plan and Illustrations.*

United Kingdom—Scotland. *Scottish G. Mag.* **23** (1907): 192–202. **Hinxman.**
The rivers of Scotland: the Beauly and Conon. By Lionel W. Hinxman. *With Map and Sections.*

United Kingdom—Somerset. **Moss.**

Geographical Distribution of Vegetation in Somerset: Bath and Bridgewater district. By C. E. Moss. London: R.G.S., 1907. Size 9½ × 6, pp. 72. *Maps and Illustrations.*

Forms one of the same series as the monographs of Dr. W. G. Smith, Mr. Lewis, and others, which have appeared in the *Journal*. The present paper is issued as an Extra Publication.

ASIA.

Philippines—Ethnology. *Philippine J. Sc.* **1** (1906): 791–876. **Worcester.**

The non-Christian Tribes of Northern Luzon. By Dean C. Worcester. *With Plates. Also separate copy, presented by the Author.*

There are 67 plates illustrating the physical characters and mode of life of these tribes.

Philippines—Geology. *Philippine J. Sc.* **1** (1906): 617–636. **Smith.**

Preliminary geological reconnaissance of the Loboo mountains, Batangas province. By W. D. Smith. *With Map, Section, and Illustrations.*

Philippines—Phytogeography. *Philippine J. Sc.* **1** (1906): 373–431, 637–682. **Whitford.**

The Vegetation of the Lamao Forest Reserve. By H. N. Whitford. *With Map and Illustrations.*

Discusses the plant-formations, which are illustrated by numerous excellent photographs.

Russia—Caucasus. *M.G. Ges. Hamburg* **21** (1906): 177–201. **Albrecht.**

Durch den Daghestan auf der Awaro- Kachetinischen Strasse im Mai-Juni 1904. Von Dr. Max Albrecht. *With Illustrations.*

Siam—Fauna. **Mortensen and With.**

Mém. A.R. Sc. Danemark, VII. Ser., **1** (1904): 1–124; **3** (1906): 1–214.

The Danish Expedition to Siam, 1899–1900. II. Echinoidea (1) by Dr. Th. Mortensen; and III. Chelonethi: an account of the Indian False Scorpions, together with Studies on the Anatomy and Classification of the Order. By C. J. With. *With Map and Plates.*

Siam—Treaty. *B. Comité Asie française* **7** (1907): 83–86. **Caix.**

Le nouveau traité franco-siamois. Par Robert de Caix.

See note in the May number (p. 569).

Turkey—Asia Minor. *Contemporary Rev.* **90** (1906): 786–800. **Ramsay.**

The Peasant-God: the Destruction and the Restoration of Agriculture in Asia Minor. By Sir W. M. Ramsay.

Turkey—Asia Minor. *B.S.G. Italiana* IV. **8** (1907): 201–229. **Vannutelli.**

Nella Turchia Asiatica. Del cav. Lamberto Vannutelli. *With Illustrations.*

AFRICA.

French West Africa. *Deutsche G. Blätter* **30** (1907): 1–23. **Beyer.**

Französisch-Westafrika. Eine Kolonialwirtschaftliche Studie. Von Prof. Dr. A. Beyer.

French West Africa. ——

Trade and Agriculture of French West Africa for the year 1905–6. (Foreign Office Annual, No. 3763, 1907.) Size 9½ × 6, pp. 30. *Price 2d.*

German East Africa. *M. deuts. Schutzgebieten* **19** (1906): 336–338. **Moisel.**

Begleitworte zu der "Karte des südlichen Teiles der Nguru-Berge." Von M. Moisel. *With Map.*

Gold Coast. *B.S. Neuchateloise G.* **17** (1906): 7–312. **Perregaux.**

Chez les Achanti. Par Edmond Perregaux. *With Illustrations.*

Kamerun—Boundary. *Petermanns M.* **53** (1907): 36–39. **Hermann.**

Die Nordwestgrenze von Kamerun. Ein Typus moderner Grenzentwickelung. Von Dr. R. Hermann. *With Maps.*

The maps show successive stages in the evolution of the boundary.

Madagascar—Ethnology. *Rev. de Madagascar* **8** (1906): 1025–1054. **Jully.**

Ethnographie de Madagascar. Par A. Jully.

Morocco. *B. Comité Afrique française* **16** (1906): 307–314. **Dyé.**
La mission hydrographique du Lieutenant de Vaisseau Dyé au Maroc (Campagne de 1906). Rapport sommaire No. 3; par le Comm. A.-Henri Dyé. *With Illustrations and Supplement.*

Morocco—Atlas. *Ann. G.* **16** (1907): 70–77. **Gentil.**
Notice sur l'esquisse géologique du haut Atlas occidental (Maroc). Par Louis Gentil. *With Map.*

North Africa—Atlas. *Jahresber. Frankfurter V.G.* **70** (1905–6): 5–87. **Knoch.**
Die Niederschlagsverhältnisse der Atlasländer. Von Dr. Karl Knoch. *With Map.*

Rhodesia. **Gregory.**
The Mining Fields of Southern Rhodesia in 1905. By J. W. Gregory. (From the *Transactions of the Institution of Mining Engineers.*) London, etc., 1906. Size $9\frac{1}{2} \times 6$, pp. 60. *Sketch-map, Illustrations, and Diagrams.*

Rhodesia. *Mem. Manchester Philosoph. S.* **51** (1906–7): No. 3 (pp. 7). **Neave.**
A Journey to North-East Rhodesia during 1904 and 1905. By S. Neave. *With Sketch-map.*

The writer went out in 1904 as naturalist to the Geodetic Survey in North-East Rhodesia. The same journal contains reports on his collections.

Rhodesia—Barotseland. *B.S. Neuchateloise G.* **17** (1906): 318–323. **Burnier.**
De Seshéké à Lealonyi par une route nouvelle. Par F. Burnier. *Sketch-map.*

The route lay east of the Zambezi, between the latter and the regular waggon road.

Rhodesia—Zimbabwe. **Hall.**
Visitors' Guide to the Great Zimbabwe Ruins: Mashonaland, Rhodesia, South Africa. By R. N. Hall. [Cape Town], 1907. Size $8\frac{1}{2} \times 5\frac{1}{2}$, pp. 34. *Plans and Illustrations. Price 1s. 6d.*

Rhodesia—Zimbabye. *Globus* **91** (1907): 229–232. **Passarge.**
Ophir und die Simbabyekultur. Von Dr. L. Passarge.

The writer believes that traces of Asiatic culture are to be seen at Zimbabye, but that it has suffered deterioration through the African medium which has transmitted it.

Sahara. *Z. Ges. E. Berlin*, 1907: 166–172. **Passarge.**
Geomorphologische Probleme aus der Sahara. Von Prof. Dr. S. Passarge.

Sahara—French. *La G., B.S.G. Paris* **15** (1907): 1–28, 103–120. **Gautier**
A travers le Sahara français. Par E.-F. Gautier. *With Map and Plan.*

Sahara—French. *B. Comite Afrique française* **17** (1907): 80–83. **Terrier.**
La frontière terrestre de l'Afrique occidentale et centrale. Par Auguste Terrier. *With Map.*

Discusses the political position in the region north-east of Lake Chad, with an account of Captain Mangin's explorations. (Cf. note in vol. **29**, p. 569.)

Sahara—French. **Touchard.**
Renseignements Col., Comité Afrique française **16** (1906): 301–317, 359–364, 371–396.
Travaux et reconnaissances de pénétration saharienne, exécuté dans le sud Constantinois par le cercle de Touggourt. Rapport du Capitaine Touchard. *With Maps and Illustrations.*

Sahara—French. **Vallier.**
Renseignments Col., Comité Afrique française **16** (1906): 269–285, 325–332, 338–358, 396–403.
Explorations dans le Ferlo, 1904–1905. Par le Capitaine Vallier. *With Maps and Diagrams.*

South Africa. **Penck.**
Süd-Afrika und Sambesifälle. Von Albrecht Penck. (Gesellschaft deutscher Naturforscher und Ärzte; Verhandlungen, 1906. Sonderabdruck.) Leipzig, 1906. Size $9\frac{1}{2} \times 7$, pp. 16. *Presented by the Author.*

Cf. note in vol. **27**, p. 630.

Sudan—River-systems. **Audoin and Adhémar.**
Renseignements Col., Comité Afrique française **16** (1906): 365–371.
Étude des relations par eau du Logone avec la Bénoué. Par MM. Audoin et d'Adhémar. *With Maps.*

See note in the **May** number, p. 570.

West Africa—Boundary. ——

Treaty Series, No. 8, 1907. Agreement between the United Kingdom and France relative to the Boundary between the Gold Coast and the French Soudan, July 19, 1906. London, 1907. Size 9½ × 6, pp. 24. *Maps. Price* 2*s.* 1½*d.*

West Africa—Ethnology. *B.G. Hist. et Descriptive* (1906): 82–119. **Maclaud.**

Étude sur la distribution géographique des races sur la côte occidentale d'Afrique, de la Gambie à la Mellacorée. Par le Dr. Maclaud. *With Map.*

West Africa—Pilot. ——

Africa Pilot, Part i.; or Sailing Directions for the West Coast of Africa, from Cape Spartel to the river Cameroon, also the Azores, Madeira, Canary, and Cape Verde Islands. 7th Edition, 1907. London, 1907. Size 9½ × 6, pp. xxiv. and 640. *Index-map. Price* 3*s.*

NORTH AMERICA.

Newfoundland. **[MacGregor.]**

Report on the foreign trade and commerce of Newfoundland, 1905–06. Size 13 × 8½, pp. vi., vi., 46, and 30. *Diagrams.*

Noticed in the Monthly Record (July, p. 91).

United States—Areas. *B.U.S. Geol. Surv.* 302 (1906): pp. 10. **Gannett.**

The areas of the United States, the states, and the territories. By Henry Gannett. *With Map.*

See note in the Monthly Record for June (p. 676).

United States—California. *Sierra Club B.* **6** (1907): 115–127. **Colby and others.**

Report on the King's River Cañon and vicinity. By Wm. E. Colby, J. N. Le Conte, and E. T. Parsons. *With Illustrations.*

United States—California. **Omori.**
B. Imp. Earthquake Investigation Com. **1** (1907): 7–25.

Preliminary note on the cause of the San Francisco earthquake of April 18, 1906. By Dr. F. Omori. *With Maps, Diagrams, and Illustrations.*

United States—Coal. *National G. Mag.* **18** (1907): 129–138. **Campbell.**

How long will the coal reserves of the United States last? By Marius R. Campbell. *With Diagrams.*

United States—Colorado. *U.S. Geol. Surv., Prof. Paper* 52 (1906): pp. 90. **Darton.**

Geology and underground waters of the Arkansas valley in Eastern Colorado. By N. H. Darton. *With Maps, Plates, and Sections.*

United States—Colorado. **Lindgren and Ransome.**
U.S. Geol. Surv., Prof. Paper 54 (1906): pp. xx. and 516.

Geology and gold deposits of the Cripple Creek district, Colorado. By Waldemar Lindgren and Frederick Leslie Ransome. *With Maps, Diagrams, and Illustrations.*

United States—Connecticut. **Rice and Others.**

Manual of the geology of Connecticut. By Dr. William North Rice and Dr. Herbert Ernest Gregory. Preliminary geological map of Connecticut. By Dr. Herbert Ernest Gregory and Dr. Henry Hollister Robinson. (State of Connecticut: State Geological and Natural History Survey, Bulletins Nos. 6 and 7.) Hartford, 1906–07. Size 9 × 6, pp. (No. 6) 274, (No. 7) 40. *Maps and Illustrations.*

United States—Geological Survey. ——

Twenty-seventh annual report of the director of the U.S. Geological Survey to the Secretary of the Interior, 1905–06. Washington, 1906. Size 9 × 6, pp. 104. *Maps.*

The map of the area covered by typographical surveys shows that there are enormous tracts of country still untouched.

United States—Georgia. *Science* **25** (1907): 428–432. **Johnson.**

River capture in the Tallulah district, Georgia. By D. W. Johnson.

United States—Irrigation. *J. Franklin I.* **163** (1907): 217–242. **Carter.**

Irrigation and the Government irrigation project at Yuma. By Prof. Oscar C. Carter. *With Map and Illustrations.*

The Yuma project is that for irrigating the lands on both sides of the lower Colorado river.

United States—Louisiana and Arkansas. **Veatch.**
U.S. Geol. Surv., Prof. Paper 46 (1906): pp. 422.

Geology and underground water resources of northern Louisiana and southern Arkansas. By A. C. Veatch. *With Maps and Plates.*

United States—Minerals. **Day and Richards.**

Black sands of the Pacific slope in 1905. By David T. Day and R. H. Richards. Washington, 1907. Size 9 × 6, pp. 84. *Presented by the U.S. Geological Survey.*

Report of an investigation regarding the useful minerals (especially platinum) occurring in the "black sands."

United States—Place-names. *B. American G.S.* **39** (1907): 103–106. ———

Names of topographic features in the United States.

Gives the results arrived at by the United States Geographic Board, after correspondence with American geographers and geologists. The name "Cordilleras" is adopted for the entire western mountain system.

United States—South Carolina. *Geological Mag.* **4** (1907): 197–202. **Hobbs.**

The Charleston earthquake of August 31, 1886, in a new light. By William Herbert Hobbs. *With Sketch-map.*

The distribution of the areas of "Craterlets," together with that of points of maximum disturbance on the railway lines, is held to point to two series of parallel fracture-planes within the rocky basement of the region.

United States—Virginia. *B. American G.S.* **39** (1907): 92–102. **Surface.**

Climate and boundaries of Virginia. By G. T. Surface.

United States—Washington. *Sierra Club B.* **6** (1907): 87–99. **Davidson.**

The name "Mount Rainier." By George Davidson.

Urges the retention of this name given by Vancouver, as against the proposed change to "Tacoma."

United States—Western. *Monthly Weather Rev.* **34** (1906): 557–559. **Henry.**

Salton Sea and the rainfall of the south-west. By Prof. Alfred J. Henry.

Shows that the Salton sea is unlikely to appreciably affect the local rainfall, though it may slightly increase the relative humidity.

United States—Wyoming and Montana. **Darton.**
U.S. Geol. Surv., Prof. Paper 51 (1906): pp. 130.

Geology of the Bighorn mountains. By N. H. Darton. *With Maps, Plates, and Sections.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Meteorology—Evaporation. *Sc. P. R. Dublin S.* **11** (1907): 137–178. **Sutton.**

A Contribution to the Study of Evaporation from Water-surfaces. By J. R. Sutton. *With Illustration.*

Many of the phenomena of evaporation are still so far a matter of uncertainty that the experiments here described are both of interest in themselves and useful as pointing to the need for further study.

Meteorology—Frost. *Meteorologische Z.* **24** (1907): 11–24, 49–64. **Dorscheid.**

Die mittlere Dauer des Frostes auf der Erde. Von Otto Dorscheid. *With Maps and Diagram.*

Meteorology—Pressure. *Z. Ges. E. Berlin* (1907): 246–253. **Baschin.**

Die geographische Verteilung des Luftdrucks und deren Änderung vom Sommer zum Winter. Von Otto Baschin.

Meteorology—Temperature. **Hann.**

Der tägliche Gang der Temperatur in der äusseren Tropenzone. A. Das Amerikanische und Afrikanische Tropenzone. Von Julius Hann. Wien, 1907. Size 12½ × 9½, pp. 88.

Meteorology—Upper Air. **Monaco.**

Meteorological Researches in the High Atmosphere. By H.S.H. the Prince of Monaco. (Reprinted from the *Scottish Geographical Magazine* for March, 1907.) [Edinburgh, 1907.] Size 9½ × 6, pp. 113–122. *Illustrations.*

Mountains. *Münchener G. Studien* **17** (1906): pp. vi. and 52. **Benl.**

Frühere und spätere Hypothesen über die regelmässige Anordnung der Erdgebirge nach bestimmten Himmelsrichtungen. Von Oskar Benl.

Mountains. *B.S. Belge Géol.* **20** (1906): **Mém.**, 171-179. **Simoens.**

De la notion du temps nécessaire à la constitution d'une chaine plissée. Par G. Simoens.

Oceanography. **Krümmel.**

Handbuch der Ozeanographie. Von Dr. Otto Krümmel. Band I. Die raumlichen, chemischen, und physikalischen Verhältnisse des Meeres. Zweite . . . Auflage. (Bibliothek geographischer Handbücher, begründet von Friedrich Ratzel. Neue Folge herausgegeben von Prof. Dr. Albrecht Penck.) Stuttgart: J. Engelhorn, 1907. Size 9 × 6, pp. xvi. and 528. *Diagrams. Price* 22*m. Presented by the Publisher.* [To be reviewed.]

Oceanography. *B.S.G. Italiana* **8** (1907): 288-304. **Marini.**

Lo sviluppo, lo stato attuale e gli odierni problemi della Talassologia. Del prof. Lodovico Marini.

Oceanography—Baltic. **Fraude.**

X. Jahresber. G. Ges. Greifswald, 1905-06 (1907): 223-350.

Grund- und Plankton-Algen der Ostsee. Von Hermann Fraude. *With Map.*

Oceanography—Baltic. *Annalen Hydrographie* **34** (1906): 464-472. **Reinicke.**

Die Eisverhältnisse in den schwedischen und russischen Gewässern der Ostee im Winter 1905-06. Von G. Reinicke.

Oceanography—Baltic. *Annalen Hydrographie* **34** (1906): 391-398, 414-423. **Witting.**

Der Bottnische Meerbusen. Eine hydrographische Uebersicht. Von Rolf J. Witting. *With Charts and Sections.*

Oceanography—Currents. **Ekman.**

Annalen Hydrographie **34** (1906): 423-430, 472-484, 527-540, 566-583.

Beiträge zur Theorie der Meeresströmungen. Von V. Walfrid Ekman. *Diagrams.*

Oceanography—Indian Ocean. *C.R.A. Sc. Paris* **144** (1907): 405-407. **Thoulet.**

Fonds sous-marins entre Madagascar, la Réunion et l'île Maurice. Par J. Thoulet.

Oceanography—Museum. ——

Führer durch das Museum für Meereskunde in Berlin. Berlin: E. S. Mittler u. S., 1907. Size $8\frac{1}{2} \times 5\frac{1}{2}$, pp. 152. *Illustrations. Presented by Prof. A. Penck.*

Oceanography—North Atlantic, etc. **Bouvier.**

B.I. Océanographique Monaco, No. **93** (1907): pp. 104.

Quelques impressions d'un naturaliste au cours d'une campagne scientifique de S. A. S. le Prince de Monaco (1905). Par E. L. Bouvier. *With Map and Illustrations.*

Oceanography—North Atlantic. *Z. Ges. E. Berlin* (1907): 173-176. **Mecking.**

Eisberge bei den Orkney-Inseln im Jahre 1836? Von D. L. Mecking.

Discusses the probability of the reported sighting of icebergs by Sir James Ross's ship *Cove.* A later note by Prof. Krümmel settles the question in the affirmative (p. 567, *ante*).

Oceanography—North Sea. **Thompson.**

Second report (northern area) on fishery and hydrographical investigations in the North Sea and adjacent waters. Conducted . . . under the superintendence of D'Arcy Wentworth Thompson. 1904-05. Part i. Hydrography. London, 1907. Size $13 \times 8\frac{1}{2}$, pp. iv. and 210. *Charts and Diagrams. Price* 4*s.* 2*d. Presented by the Fishery Board for Scotland.*

Oceanography—Pacific. *Queensland G.J.* **21** (1905-06): 71-134. **Murray.**

On the depth, temperature of the ocean waters, and marine deposits of the south-west Pacific Ocean. By Sir John Murray.

Read at the Queensland Geographical Society's Anniversary celebration (see *Journal*, vol. **28**, p. 514).

Oceanography—Pacific. *Annalen Hydrographie* **35** (1907): 108-113. **Schott.**

Lotungen I.N.M.S. "Edi" und des deutschen Kabeldampfers "Stephan" im westlichen Stillen Ozean. Von G. Schott. *With Charts.*

Noticed in the June number (vol **29**, p. 679).

Oceanography—Plankton. **Schröder.**
Vierteljahrsschrift Naturfors. Ges. Zürich **51** (1906): 319–377.
Beiträge zur Kenntnis des Phytoplanktons warmer Meere. Von Bruno Schröder. *With Illustrations.*

Oceanography—South Pacific. **Haswell and others.**
Records Australian Museum **6** (1907): 271–311.
The results of deep-sea investigation in the Tasman Sea. I. The expedition of H.M.C.S. *Miner.* By W. A. Haswell, C. Hedley, and E. J. Goddard. *With Illustrations.*

Oceanography—Terms. *Riv. G. Italiana* **13** (1906): 441–452, 523–531. **Ricchieri.**
Terminologia morfografica dei fondi oceanici. Considerazioni e proposte del Prof. Giuseppe Ricchieri.

Criticism, in matters of detail, of the recommendations of the international committee (*Journal*, vol. **22**, p. 191).

Oceanography—Voyage. *Annalen Hydrographie* **35** (1907): 145–149. **Schott.**
Kapitänleutnant Lebahn und die Forschungsreise S.M.S. *Planet.* Von Gerhard Schott. *With Chart.*

Oceanography—Voyage. **[Lebahn.]**
Annalen Hydrographie **34** (1906): 145–147, 220–227, 259–265, 305–313, 353–365, 409–414, 457–464, 505–510, 556–562.
Die Forschungsreise S.M.S. *Planet. With Charts, Diagrams, and Illustrations.*

See note in the January number (p. 94).

Phytogeography. *T. Nat. Hist. S. Glasgow* **7** (1904–05): 225–235. **Ewing.**
An Œcological Problem. By Peter Ewing.

Discusses the relation of alpine plants to the rocks on which they are found. (See p. 330, *ante.*)

Rivers. *Riv. G. Italiana* **14** (1907): 95–78. **Issel.**
Il concetto della direzione nei corsi d'acqua. Nota di A. Issel. *With Diagrams.*

Discusses the different senses in which the idea of direction is applicable to the course of a waterway. (See July number, p. 95.)

Sea-level. *Geological Mag.*, Dec. v., **4** (1907): 115–121. **Pearson.**
Deformation and variation in the sea-level. By H. W. Pearson.

Seismology. *Atti R. A. Lincei, Ser.* V., *Rendiconti* **16** (1907): 1 Sem., 384–395. **Marchi.**
Teoria elastica delle dislocazioni tectoniche. Nota di L. De Marchi.

Seismology. **Upham.**
The San Francisco and Valparaiso earthquakes and their causes. By Warren Upham. (From the *Transactions* of the Victoria Institute.) [London, 1907.] Size $8\frac{1}{2} \times 5\frac{1}{2}$, pp. 18. *Map.*

Snow. *Alpine J.* **23** (1907): 379–386. **Hoek.**
On snow avalanches. By Dr. H. Hoek.

Zoogeography. *Report Smithsonian I.* (1905): 375–402. **Allen.**
The influence of physical conditions in the genesis of species. By Joel A. Allen.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Historical—Marco Polo. *Riv. G. Italiana* **14** (1907): 107–108. **Vacca.**
Un manoscritto inedito del viaggi di Marco Polo. Di Giovanni Vacca.

Refers to a Catalan manuscript in a script resembling that of the famous Catalan Atlas of 1375, which it is thought to precede in date.

Historical—Navigation. *M.G. Ges. Hamburg* **21** (1906): 63-176. **Behrmann.**
Ueber die niederdeutschen Seebücher des funfzehnten und sechzehnten Jahrhunderts. Von Dr. Walter Behrmann. *With Facsimile maps, and Illustrations.*

Medical Geography. **Brunton.**
The Influence of Climate upon Health and Disease. By Sir Lauder Brunton. (Paper . . . at the British Association, Cape Town, 1905.) Size $8\frac{1}{2} \times 5\frac{1}{2}$, pp. 20.

Missions. ——
Outline History of C.M.S. Missions. Vol. 3. London: Church Missionary Society, 1907. Size $7\frac{1}{2} \times 5$, pp. 160. *Maps. Presented by the Publishers.*

GENERAL.

Geography. *G. Teacher* **4** (1907): 19–28. **Unstead.**
The meaning of geography. By J. F. Unstead.

Photography—Pocket-book. ———
Wellcome's photographic exposure record and diary, 1907. London, etc.: Burroughs Wellcome & Co., [*not dated*]. Size $5\frac{1}{4} \times 3$, pp. 268. *Illustrations.*

An earlier issue of this useful pocket-book (in which minor improvements are constantly introduced) was noticed in vol. **25**, p. 335.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Denmark. **Danish General Staff.**
Topografisk Kaart over Kongeriget Danmark. Scale 1 : 40,000 or 1·6 inch to 1 stat. mile. Sheets: Amager, Anholt, Ballerup, Hesnæs, Höje Taastrup, Kjöbenhavn, Marienborg, Nykjöbing (Falster), Sommerspiret, Svaneke, Vigsnæs. Copenhagen: Danish General Staff, 1906–1907. *Presented by the Danish Government.*

England and Wales. **Ordnance Survey.**
Sheets published by the Director-General of the Ordnance Survey, Southampton, from September 1 to 30, 1907.

4 miles to 1 inch:—

County Diagrams, showing Civil Parishes, with a table of their areas—**Radnorshire, Warwickshire.** *Price* **6*d.*** *each.*

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Large-sheet series, printed in colours, folded in cover or flat in sheets, 13, 19, 22, 97. *Price, on paper,* 1*s.* 6*d.*; *mounted on linen,* 2*s.*, *mounted in sections,* 2*s.* 6*d.* *each.*

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Carmarthenshire, 12 S.E., 27 S.W., 29 N.E., S.E., 33 N.E., S.E., 34 N.E., 35 S.W., 38 N.W., 40 N.W., 41 N.W., N.E., 46 S.W., 49 N.W., S.E. **Cornwall,** 28 S.W. **Devonshire,** 104 S.E., 124 N.W. **Lincolnshire,** 25 S.E., 26 N.E., S.E., 27 N.E., 30 S.E., 36 S.E., 40 S.W., 41 S.E. **Norfolk,** 75 S.W. **Pembrokeshire,** 2 S.W., (3 S.E. and 7 N.E.), 6 N.E., (7 N.E. and 3 S.E.), 12 N.W. **Yorkshire (First Revision of 1891 Survey),** 264 S.W., 265 N.W., 266 S.W., 278 S.W., 281 S.W. 1*s.* *each.*

25-inch—County Maps:—

Cornwall (First Revision), XLVII. (12 and 8); XLVIII. 5, 9, 13; L. 8; LVI. 3, 7, 8, 11; LVII. 1; LVIII. 6, 14, 15; LIX. 8; LXV. 7, 15; LXXII. 1, 6, 9, 14; LXXXIV. 10. **Kent (Second Revision),** XXII. 14; XXIII. (7 and 11), 9, (11 and 7), 12, 13, 14, 16; XXIV. (6 and 5), 7, 9, 10, 11, 13, 14; XXXIV. 2, 3, 4, 6, 7, 8, 10, 11, 12, 14, 15, 16; XXXV. 1, 5, 9, 10, 13, 14, 16; XXXVI. 2, 3, 13; XLV. 2, 3, 4, 8, 12, 14, 15, 16; XLVI. 1, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13; XLVII. 1, 5, 9; LV. 2, 3, 4, 6, 7, 8, 10, 11, 12, 14; LVI. 1, 5, 9; LXV. 3, 8; LXVI. 1; LXVIII. 13, (14 and 15); LXXIV. 1. 3*s.* *each.* **Lancashire (First Revision of 1891 Survey),** CVIII. 3, 4, 7, 8, 9, 10, 13; CXI. 2; CXIV. 1, 5. **Lincolnshire** (First Revision), IX. 10, 11, 12, 16; XXI. 6. 3*s.* *each.* IX. 4, 6, 7. 1*s.* 6*d.* *each.* **Norfolk** (First Revision), LXXV. 8, 12; LXXVI. 5, 6, 7, 8, 10, 11, 12, 14, 15, 16; LXXVII.

5, 9, 10, 13; LXXXVIII. 4; LXXXIX. 1. **Pembrokeshire** (First Revision), VIII. 11, 13, 14, 15, 16; IX. 9, 13; XV. 1, 4, 5, 6, 7, 8; XVI. 1, 5, 12; XVII. 5, 13; XXXI. 4; XL. 15, 16; XLI. 13, 14; XLIII. 3, 4; XLIV. 1, 2, 5. **Yorkshire** (First Revision of 1891 Survey). CCXXIX. 3, 4, 7, 11, 12, 16; CCXXX. 11, 16; CCXXXIII. 12; CCXXXVI. 5, 6, 11, 12, 13, 14, 16; CCXLIX. 3, 4. *3s. each.* CCLIII. 16. *1s. 6d.*

(*E. Stanford, London Agent.*)

England and Wales. **Geological Survey.**

1-inch map—New Series. Colour printed. Penzance (351 and 358 combined). *2s. 6d.*

(*E. Stanford, London Agent.*)

England—London. **Stanford.**

Stanford's special map of the railways and electric tramways of London and its environs. Scale 1 : 63,360 or 1 inch to 1 stat. mile. London : Edward Stanford. 1907. *Price* 1*s.*

France. **Service Géographique de l'Armée, Paris.**

Carte de la France dressée par ordre du Ministre de l'Intérieur. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets: x.–13, Vire; xvii.–35, St. Pons; xvii.–39, Céret; xx.–25, Amplepuis; xxi.–24, Beaujeu; xxvi.–25, Chamonix. Paris: Service Géographique de l'Armée, Service Vicinal, 1907. *Price* 0.80 *fr. each sheet.*

Germany. **K. Preuss. Landesaufnahme.**

Karte des Deutschen Reiches. Herausgegeben von der Kartographischen Abteilung der Kgl. Preuss. Landesaufnahme. Scale 1: 100,000 or 1 inch to 1·6 stat. miles. Sheets (coloured), 264, Klötze; 265, Gardelegen; 289, Obisfelde; 290, Neuhaldensleben. Berlin: K. Preuss. Landesaufnahme, 1906. *Price* 1.50*m. each sheet.*

Turkey. **Topographical Section, General Staff.**

Map of Turkey. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Sheets: Rodosto; Vize. London: Topographical Section, General Staff, War Office, 1907. *Price 2s. 6d. net each sheet. Presented by the Director of Military Operations.*

These are two sheets of the map of Turkey noticed in the *Geographical Journal* for July, 1906. They adjoin the Constantinople sheet—one, "Vize," to the north; and the other, "Rodosto," to the west. Relief is shown by approximate contours in brown at intervals of 100 feet.

ASIA.

Asia. **Johnston.**

The World-wide Series of Library and Office Maps. Asia. Scale 1 : 9,218,880 or 1 inch to 145·5 stat. miles. Edinburgh: W. & A. K. Johnston, [1907]. *Price* 15*s. Presented by the Publisher.*

A general map of Asia upon which political boundaries, principal railways, etc., seem to have received careful attention. The unnecessarily heavy colouring renders the names and detail somewhat indistinct. As regards geographical features, the map in parts needs more thorough revision to bring it up to date. This is specially the case with regard to Tibet.

China. **Willis.**

Geologische Karten der Distrikte Sin-t'ai und Ch'ang-hia (Provinz Shan-tung). Von Bailey Willis. Scale 1 : 175,000 or 1 inch to 2·7 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1907, Tafel 18. Gotha : Justus Perthes, 1907. *Presented by the Publisher.*

Daghestan. **Dirr.**

Sprachenkarte des Mittellaufes des Andischen Koissu (Daghestan). Von A. Dirr. Scale 1 : 420,000 or 1 inch to 6·6 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1907, Tafel 17. Gotha : Justus Perthes, 1907. *Presented by the Publisher.*

AFRICA.

British East Africa. **Topographical Section, General Staff.**

British East Africa. Lumbwa and Sotik reconnaissance map. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. London : Topographical Section, General Staff, War Office, 1907. *Price* 2*s. Presented by the Director of Military Operations.*

A preliminary reconnaissance of the country immediately east and south-east of

Kavirondo gulf, Victoria Nyanza. The relief is shown by four lines in brown at approximate 200-feet intervals.

Cape Colony. **Topographical Section, General Staff.**

Map of Cape Colony. Reconnaissance Series. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Sheets: 127-E, Orange River mouth; 127-F, Stinkfontein; 127-K and L, Port Nolloth and O'Okiep; 128-R, Britstown. London: Topographical Section, General Staff, War Office, 1907. *Presented by the Director of Military Operations.*

Congo State. **Department of the Interior, Congo Free State Government**

Carte politique de l'État Indépendant du Congo, 1907. Scale 1 : 4,000,000 or 1 inch to 63·1 stat. miles. Brussels, 1907. *Presented by the Secretary, Department of the Interior, Congo Free State Government.*

This small official general map is important, inasmuch as it shows the partition of the Congo Free State into districts, as well as railways constructed and proposed, and telegraphs. Waterways navigable for steamers are coloured blue, while those not so navigable are left uncoloured. An index to the positions, government stations, or posts, is given at the side of the map.

Congo State. **Dept. of the Interior, Congo Free State Government.**

Carte du District du Kasai. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. Brussels: Falk Fils, 1907. *Presented by the Secretary, Department of the Interior, Congo Free State Government, Brussels.*

A route-map compiled principally from sketches and compass traverses made by the Congo Free State officials while passing between the different stations in the execution of their duties. The map contains far more detailed information than any other of the district that has hitherto appeared. Routes are shown in red, water blue. Maps of other districts have been prepared on the same scale. Doubtless the information they contain will be available to the public on the 1 : 1,000,000 map of the whole state which it is understood will be published next year.

Egypt. **Survey Department, Cairo.**

Provisional map of Beheira Mudiria. Scale 1 : 125,000 or 1 inch to 1·9 stat. mile. 4 sheets. Cairo: Survey Department, 1907. *Presented by the Director-General, Survey Department, Cairo.*

The Beheira Mudiria includes Alexandria and the western section of the delta of the Nile. Names and notes are in native character and English.

Egypt. **Survey Department, Cairo.**

Topographical map of Fayum Province. Scale 1 : 10,000 or 6·3 inches to 1 stat. mile. Sheets: S.W. 15-6, 15-8, 15-9, 15-10, 15-11, 15-12, 15-13, 16-1, 16-2, 16-4, 16-5, 16-6, 16-7, 16-8, 16-9, 16-10, 16-11, 16-12; S.E. 16-1. Cairo: Survey Department, 1907. *Presented by the Director-General, Survey Department, Cairo.*

Gold Coast. **Guggisberg.**

Map of the Gold Coast. Published by the authority of Sir John Pickersgill Rodger, K.C.M.G., Governor, under the direction of Major F. G. Guggisberg, R.E., F.R.G.S., Director of Surveys, Gold Coast. Scale 1 : 125,000 or 1 inch to 1·9 stat. mile. Sheet 71 K I. Comassie (Kumase). Edinburgh and London: W. & A. K. Johnston, 1907. *Price 2s. each sheet. Presented by Major F. G. Guggisberg, R.E., Director of Surveys, Gold Coast.*

Orange River Colony. **Topographical Section, General Staff.**

Map of Orange River Colony. Scale 1 : 125,000 or 1 inch to 1·9 stat. mile. Sheets: 127-U-II., Bothaville; 127-U-IV., Odendaals Rust. London: Topographical Section, General Staff, War Office, 1906. *Presented by the Director of Military Operations.*

Tunis. **Babelon, Cagnat, and Reinach.**

Atlas archéologique de la Tunisie. Édition speciale des cartes topographiques publiées par le Ministère de la Guerre accompagnée d'un texte explicatif par MM. E. Babelon, R. Cagnat, S. Reinach. 10e et 11e Livraison. Paris: Ernest Leroux, 1905.

AMERICA.

Canada. **Dept. of the Interior, Ottawa.**

Sectional map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheet: Victoria, revised to July 30, 1907. Ottawa: Department of the Interior, Topographical Surveys Branch, 1907. *Presented by the Department of the Interior, Ottawa.*

Canada. **Johnston.**

Commercial and School Wall-map of the Dominion of Canada. Scale 1 : 2,770,000 or 1 inch to 44 stat. miles. Edinburgh: W. & A. K. Johnston. Toronto: George M. Hendry Co., 1907. *Price £1 7s. 6d. Presented by Messrs. W. & A. K. Johnston.*

This is a good and clearly executed general map of the Dominion of Canada suitable for hanging in schools or offices. It has been compiled from the latest information, special attention being paid to railways, river systems, and boundaries. This relief is boldly and somewhat roughly indicated by brown shading. The natural products of the various districts are given in red, but these cannot be considered as at all complete, although giving an idea of some of the more leading products only. The map measures 84 inches × 50 inches, and can be obtained at the same price either mounted to fold in cloth case or on rollers varnished to hang on a wall.

Chile. **Oficina de Limites, Santiago.**

Comision Chilena de Limites. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Sheets: Llanquihue, lat. 46° S. to 47° S.; Magallanes, lat. 47° to 48° S.; Magallanes, lat. 48° S. to 49° S. Santiago: Oficina de Limites, 1907. *Presented by the Director, Oficina de Limites, Santiago.*

Additional sheets of the surveys of the Chilian Boundary Commission, similar in style to those already noticed in the *Geographical Journal*. In each case the topographical sheet is accompanied by one showing the lines of traverses and intersected points upon which the survey was chiefly based.

GENERAL.

Time Dial. **Gregory.**

Philips' Standard Time Dial. Designed by Prof. R. A. Gregory, F.R.A.S., Professor of Astronomy, Queen's College, London. London: George Philip & Son, Ltd., 1907. *Price 3s. 6d. net. Presented by the Publisher.*

For showing the relative time of the principal cities and countries of the world, and the relation between time and longitude generally, there is nothing to be compared with globes for educational purposes; but these are costly and inconvenient in size, so several attempts have been made to construct movable diagrams for the purpose. Some of these have been fairly successful, but they have frequently proved unsatisfactory for teaching through lack of simplicity and clearness, or on account of the distortion due to the projection employed. Prof. R. A. Gregory has now produced a diagram on a thick board, suitable for schools, which has decided advantages over any hitherto published. This consists of the usual clock-face dial divided in twenty-four hours, with a revolving map, on a card, in the centre; but instead of attempting to show the whole world, necessarily much distorted, on one map, as has been done before, the diagram is reversible, and upon one face, a map of the northern hemisphere only is shown, while upon turning the diagram over will be found another clock-dial, similar to the first, with the southern hemisphere on the revolving card in the centre. This division of the globe at the equator is a great improvement, and renders the diagram far more intelligible to children. Upon the maps the Greenwich meridian is shown by a thick line, while the different "time zones" are also indicated, so that the local standard time can be found which corresponds to any particular Greenwich time.

World. **Harmsworth.**

Harmsworth Atlas and Gazetteer. Parts 24 and 25. London: The Amalgamated Press, Ltd., 1907. *Price 7d. each part.*

These parts contain the following maps: Part 24, Nos. 43, South-East Ireland; 44, Plans of London, Edinburgh, and Dublin; 97–98, Central and South Russia; 183–184, West Indies. Part 25, Nos. 37–38, Ireland, railway systems; 65–66, Eastern Switzerland; 149–150, Natal, Transvaal, and Orange River Colony.

World. **Morrison.**

Bacon's Elementary Relief Atlas containing thirty-six plates of coloured relief and political maps of the world, with index. Edited by Marcus G. Morrison, F.R.G.S. London: G. W. Bacon & Co., Ltd., [1907]. *Price 8d. Presented by the Editor.*

Mr. M. G. Morrison has here attempted to produce a cheap little general atlas for elementary educational purposes that shall be, as far as the means placed at his disposal would allow, on the more approved and intelligent lines of recent times. In order to give young scholars a general idea of the leading physical features of the continents and principal countries, he has placed by the side of the political map a photographic reproduction of a model on the same horizontal scale, with an effect

that is decidedly graphic if not altogether accurate. The chief fault, which indeed is common to many such attempts, is the exaggerated idea of height conveyed, and in places, the lack of true proportion between lower and higher elevations. A nicely drawn little map of the whole world on Mollweide's elliptical projection, showing relative heights by tinting, is given at the commencement of the atlas, together with other general diagrams and plans. There are altogether thirty-six sheets of maps and diagrams, and if the execution of some of them is rather rough and crude, it must be remembered that the price is very low, and too much cannot be expected for the modest sum of eightpence. There is an index to place-names.

Charts.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during August, 1907. *Presented by the Hydrographer, Admiralty.*

New Charts.

No.	Inches.	
2881 m =	1·4, 3·6, 3·6	Gulf of Mexico:—Key West harbour and approaches. Plans of Key West harbour and north-west channel bar. 3*s*.
1739 m =	2·9	China:—Chu-Kiang or Canton river, sheet V. Whampoa channel and Changshan island to Canton. 3*s*.
3649 m =	2·9	Tasmania, north coast:—Entrance to river Tamar. 3*s*.

New Plans and Plans added.

No.	Inches.	
2799 m =	2·0, 1·5	South America, west coast:—Plans on the coast of Ecuador and Peru. Plan added:—Port Bayovar. 2*s*.
1115 m =	—	China, north-east coast:—Yang tse kiang, sheet V. Yo-chau-fu to Kwei-chau-fu. Plans added:—Sketch of Tching Tan. Sketch of Kung Ling Tan. 4*s*.
1268 m =	1·9, 3·9	Plans in the Kuril islands. Plans added:—Shari road, Rausu road. New plan:—Anama harbour. 2*s*.

Charts Cancelled.

No.	Cancelled by	No.
2881 Gulf of Mexico:—Key West harbour and approaches. Plan of Key West harbour.	New chart. Key West harbour and approaches. Plan of Key West harbour, plan of north-west channel bar	2881
1739 China:— Canton river, sheet V. Whampoa channel and Changshan island to Canton. Index sheet of Canton river.	New chart. Chu Kiang or Canton river, sheet V. Whampoa channel and Changshan island to Canton	1739
1080 Tasmania, north coast:—River Tamar from the sea to Launceston. Plan of Port Dalrymple on this sheet.	New chart. Entrance to river Tamar	3649

Charts that have received Important Corrections.

No. 1188, The World:—Coal and Telegraph chart. 1481, Scotland, east coast:—River Tay. 2495, Ireland, south coast:—Kenmare river, etc. 3158, Norway:—Nevlungbavn to Torbiornskier, etc. 3159, Norway:—Torbiornskier to Jælöen. 881, Norway:—Aakre to Hisken, etc. 2309, Norway, sheet VII.—Leka to Donnæsö. 2628, Malta island, south-east portion. 644, Africa, east coast:—Delagoa bay (*Lorenzo Marques*). 216*a*, Bay of Bengal, Mergui archipelago:—Lord Loughborough island to Mergui. 3612, China, south coast:—Port Shelter and Rocky harbour. 1760, China, east coast:—The Brothers to Ockseu islands, etc. 2513, New Zealand:—Napier port and harbour.

Danish Chart. **Danish Admiralty.**

Danish Hydrographic Charts. Nos.: 213, Islands Westkyst, Reykjavik og Hafnarfjords med Omgivelser; 214, Islands Ostkyst, Langanes-Vestrahorn. Copenhagen: Danish Admiralty, 1907. *Presented by the Danish Admiralty.*

Indian Ocean and Red Sea. **Meteorological Office.**

Monthly meteorological chart of the Indian ocean north of 15° S. lat. and Red

sea, October, 1907. London: Meteorological Office, 1907. *Price 6d. each. Presented by the Meteorological Office.*

Mersey River. **Belam and Ashton.**

Chart of the River Mersey from Rock Lighthouse to Warrington Bridge, 1906. By Commander Henry Belam, M.V.O., R.N., Marine Surveyor, and H. G. G. Ashton, F.R.G.S., Assistant Marine Surveyor, Mersey Docks and Harbour Board. Scale 1:38,400 or 1·65 inch to 1 stat. mile. Liverpool: Mersey Docks and Harbour Board, 1906. *Presented by H. G. G. Ashton, Esq.*

This is a continuation of the chart previously published by the same authors, and extends from New Brighton to Warrington, thus including the lower course of the Manchester Ship Canal. It shows the position of sandbanks, in addition to many lines of soundings taken at close intervals across the river, but has evidently been reduced by photography from a much larger drawing, with the result that the figures, details, and smaller lettering are in many places illegible without the aid of a glass.

North Atlantic and Mediterranean. **Meteorological Office.**

Monthly meteorological chart of the North Atlantic and Mediterranean, October, 1907. London: Meteorological Office, 1907. *Price 6d. each. Presented by the Meteorological Office.*

North Atlantic. **U.S. Hydrographic Office.**

Pilot chart of the North Atlantic ocean, September, 1907. Washington: U.S. Hydrographic Office, 1907. *Presented by the U.S. Hydrographic Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot chart of the North Pacific ocean, October, 1907. Washington: U.S. Hydrographic Office, 1907. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Arabia and Persia. **Wilson.**

Thirty-one photographs of Arabia and Persia, taken by A. T. Wilson, Esq. *Presented by A. T. Wilson, Esq.*

A remarkably good set of photographs depicting places of interest in Southern Persia and along the shores of the Persian gulf. They also give a good idea of the scenery characteristic of the region. The following are the titles:—

(1) Maskat; (2) Fort and beach, Jask; (3) Native village, Hormuz island; (4) The old Portuguese fort, Hormuz island; (5) The fort and beach, Hormuz island; (6) Fort, beach, and village, Hormuz island; (7) Camels drinking at well near Bandar Abbas; (8) Desert near Naband, Kuh-i-Ginao in distance; (9) Bandar Abbas, old British consulate at Naband; (10) Bandar Abbas, quarantine station; (11) Bandar Abbas, view from Naband; (12) Desert near Khana Surkh; (13) Wind-eroded rocks near Gatchin; (14) Tang-i-Chakabak; (15) Birkeh Sultan, serai and cistern; (16) Rudare valley; (17) Valley of the Rasul river; (18) Sunset near Birkeh Nuh; (19) Date grove near Sartang; (20) Temporary bridge near Abbasabad, Kara Agatch river; (21) Entrance of Kara Agatch river into Tang-i-Tadun; (22) Exit of Kara Agatch river from Tang-i-Tadun; (23) Kara Agatch valley from hills east of Azimungird; (24) Sarvistan valley, from hills east of Azimungird; (25) Kara Agahh valley from above Kunjun; (26) Lake Maharlu from Kunjun; (27) Lake Maharlu from near Goshnakun; (28) Tomb of Hafiz, Shiraz; (29) Entry of governor into Shiraz, artillery; (30) Entry of governor into Shiraz, escort; (31) Entry of governor into Shiraz, band of camels.

Ceylon. **Varley.**

Eleven photographs of Ceylon, taken by F. J. Varley, Esq., Indian Civil Service. *Presented by F. J. Varley, Esq.*

Mr. Varley's latest addition to our collection consists of the following small photographs of Ceylon:—

(1) Pidrutalagala mountain, from Nuwara Eliya; (2–4) Views from summit of Pidrutalagala; (5 and 6) Views of the lake at Nuwara Eliya; (7) Tea estates and mountain railway, Nuwara Eliya; (8) Falls near Nuwara Eliya; (9) View on road to Kandapola; (10) Hakgala mountain; (11) Diyatalava, with Boer prisoners' camp.

Congo State. **Torday.**

Five photographs of the Congo State, taken by E. Torday, Esq. *Presented by E. Torday, Esq.*

Mr. E. Torday has visited the comparatively little-known region of the Kuilu,

with the ice, generally more or less embedded in it, and where the ice does not melt away, or there is no open water of importance, the driftwood gets very little opportunity of being thrown on to the beach. It can only happen by very rare accidents. We must therefore expect to find extremely little driftwood on the ice-bound coasts at present.* As an example, it may be mentioned that only very little driftwood is found on the northern coasts of Franz Josef Land, although this group of islands are not very far distant from the great rivers of Siberia, and although a fairly continuous transport of driftwood is carried with the ice past the islands.

But the fact that modern driftwood, either Siberian or American, is found on the northern coasts of Greenland, Ellesmere Land, and the Parry archipelago, and even on an ice-floe a few miles off the northern coast of Ellesmere Land (as mentioned by Admiral Parr during the discussion after Markham's above-mentioned paper), proves with all desirable certainty that this ice is not stationary, but has been drifted across the North Polar sea, and that there is a continual ice-drift across the unknown region. But this fact hardly speaks in favour of much land in the Unknown North.

Diatomacea on the Ice.—I may in this connection also draw attention to the *diatoms* found on the surface of the polar ice-floes, which, when studied more carefully, might give important information as to the drift and origin of the ice met with in the Beaufort sea, and to the north of the American Arctic archipelago and Greenland. The diatoms found in mud I had collected on ice-floes in the Denmark strait, near Iceland, formed to me, before I started, one of the best evidences that there is a continual ice-drift across the North Polar sea by which a ship could be carried.

The Cold Bottom-Water of the North Polar Basin.—My chief evidence to prove a wide extension of the North Polar basin, was formerly† the existence of a cold bottom water in that sea. As this bottom water has a higher salinity (above 3·5 per cent.), and is also somewhat warmer than that of the Norwegian sea, having at the same time a higher density, the two basins must be separated by a submarine ridge (see Fig. 5), extending from Spitsbergen north-westwards towards Greenland, and it is not probable that the two different bottom waters can have the same source, or be formed in the same region. The bottom water of the North Polar basin must be formed inside that

* It is consequently erroneous when Mr. R. A. Harris believes that the probable existence of land to the north preventing the driftwood from being carried across from Siberia, should be proved by the fact that the amount of driftwood found along the northern coast of Greenland is small in comparison with that found on the northern coast of Spitsbergen, or the eastern coast of Greenland.

† See *Norwegian North Polar Expedition*, 1893–96. *Scientific Results*, vol. 3, No. 9, pp. 399 *et seq.*; vol. 4, No. 13, pp. 227, 228.

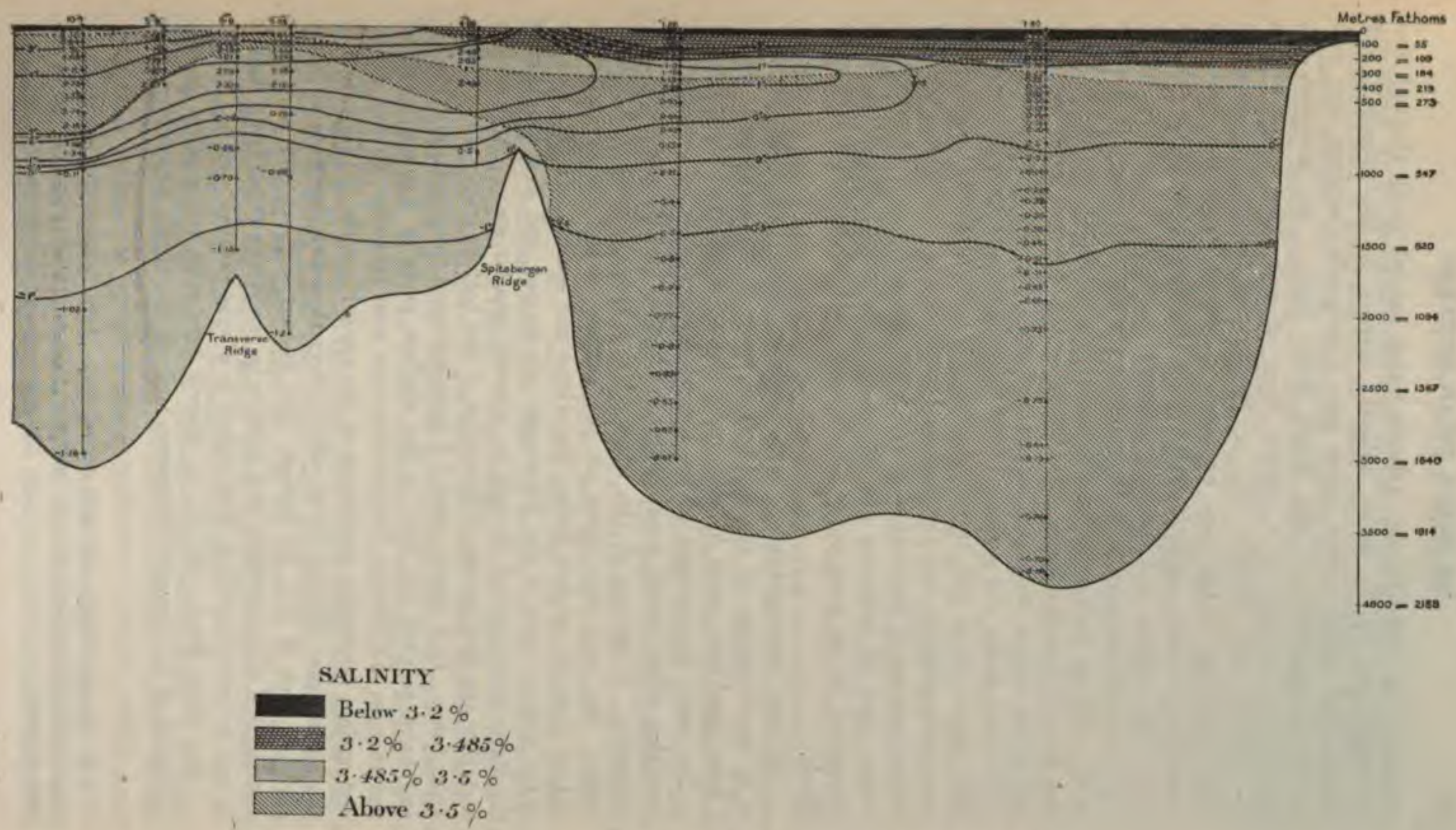


FIG. 5.—SECTION ACROSS NORTH POLAR BASIN AND NORWEGIAN SEA.

sea, and it is evidently the Atlantic water, carried north through the Norwegian sea by the warm Atlantic current, or the so-called Gulf Stream, and cooled down below zero Centigrade (between zero and $-0°\cdot 9$ C.) somewhere in the North Polar basin. As, however, the latter sea is covered by a surface layer of cold polar water with a low salinity and density, 150 or 200 metres (about 100 fathoms) thick, wherever it has been explored, it seemed improbable that the underlying warmer Atlantic water could anywhere come to the surface inside this region, and the only manner in which it could be cooled down, seemed therefore to be by contact with the overlying cold surface layer. But as such a cooling process would necessarily require a very long time to give the warm Atlantic water the observed lower temperature of the bottom water, and as everywhere along the *Fram's* track the cold bottom water was separated from the cold surface layer by a warmer water-layer, about 600 or 700 metres (320 to 380 fathoms) thick, with temperatures above zero Centigrade, I came to the conclusion that this cooling process of the bottom water must take place in some extensive, distant area of unknown sea, and that consequently the deep basin discovered by us must cover the greater part of the still Unknown North.

By later investigations I have, however, come to a different view as to the formation of the cold bottom water of the north polar basin. I have found that warm Atlantic water cannot possibly be cooled down to the lower temperature of the bottom water simply by contact with overlying colder water, even though the North Polar basin were ever so extensive. A cooling of the water of this kind, to form cold bottom waters, can only take place in the surface of the sea by radiation of heat from the surface during the winter and spring. In this manner is the bottom water of the Norwegian sea formed, and so is also that of the Barents sea formed, though on a much smaller scale. And such is certainly also the process of formation of the bottom water of the North Polar basin. In a recent paper * I have discussed this question in detail, and have pointed out that in the shallow parts of the sea north of Spitsbergen and Novaya Zemlya there are most probably, during winter and spring, favourable conditions in the sea-surface for the formation of the north polar bottom water, and it may therefore originate in these regions. But if this be correct, the known vertical and horizontal distribution of temperature and salinity in the North Polar basin cannot be said to prove anything with regard to a wide extension of this basin.

The Tidal Wave.—Mr. R. A. Harris lays very much stress on the evidences of an extensive unknown land in the north, which he thinks

* F. Nansen, "Northern Waters: Captain Roald Amundsen's Oceanographic Observations in the Arctic Seas in 1901," *Videnskabs-Selskabets Skrifter, Kristiania*. 1905, 1, No. 3.

is given by the marked difference in the range of the tide on Bennett island (about 2 feet) and on the coast of Alaska (about 0·4 foot). He cannot account for this difference unless an extensive land in the Unknown North prevents the tidal wave from crossing the North Polar basin straight from Spitsbergen to Alaska, and instead, compels it to make the circuit round by Bennett island. Mr. Harris does not, however, take up for discussion the difficult problem of the tidal phenomenon in the North Polar sea. On the whole, his conclusions are simply based on a very small number of observations of rather an accidental nature; and he has hardly quite realized how very complicated and difficult tidal problems of this kind may be. As an example, it may be mentioned that the range of the tide which I observed on the northern coast of Franz Josef Land was hardly as much as 2 feet, which the *Jeannette* people found on Bennett island, and still Franz Josef Land is nearer to the Atlantic, and is not protected by land to the north. As another example may be mentioned Northern Norway, where the tides are considerably higher on the coast of Eastern Finmarken and on the Murman coast than, for instance, Tromsö or on the Lofoten islands. If Mr. Harris's method of arguing were correct, this would naturally lead to the absurd conclusion that the latter coast must be protected by land outside, and that the Atlantic tidal wave reaches the Murman coast and Eastern Finmarken before it reaches the Lofoten islands. Mr. Harris has evidently not been aware that the facts mentioned by himself speak against his own method of reasoning. Pitlekaj, where the *Vega* wintered in 1878–79, near Bering straits, is not much further distant from Bennett island than Point Barrow, but nevertheless the mean range of the semi-diurnal tide is there only 0·2 foot, whilst it is double, 0·4 foot, at the latter place. The range of the tide and its periods are greatly influenced by various conditions, and not merely by the distance which the tidal wave has to travel. The trend of the coast, the depths of the sea outside them, are of importance, and very often there are several tidal waves, coming from different directions; the range of the tide may then differ much at short distances according as these waves coincide.

An intelligent study of the tidal phenomena along the Arctic coasts might tell us much about the depths and geography of the Unknown North; but then we shall have to take all sides of the question into consideration, and we shall want a good material of systematical tidal observations taken in different parts of the region.

The Meteorology of the Arctic Regions.—The meteorology of a region is greatly influenced by the distribution of land and water. Extensive land masses are apt to create a continental climate, whilst great expanses of open sea produce a maritime climate. If the sea be covered by ice it has not this maritime effect to the same degree as if it were open, but it will nevertheless make the climate more maritime than if it

were replaced by land. A careful study of the meteorology of the known Arctic Regions might thus give some information as to the probable distribution of land and water in the Unknown North. The meteorological observations of the *Fram* Expedition, 1893–96, in the North Polar sea hardly indicate that there can be any very extensive land masses in the Unknown North, for, if so, the climate along the *Fram's* route might have been expected to be more continental.

Migratory Birds.—Some travellers—as, for instance, recently, Mr. Einar Mikkelsen—have attached much importance to migratory birds travelling northwards into the unknown, as evidences of land in that direction. One has, however, to be cautious in trusting evidences of this kind. It depends naturally much on what kind the migratory birds are, but the routes along which they travel are often very puzzling. For instance, the fact that a great number of birds pass Point Barrow in the spring on their way towards the north-east, need not prove anything with regard to unknown land in that direction, as the birds might be on their way to Banks island and the Parry islands, and it is just probable that the migratory birds of those regions come to a great extent by the route of Point Barrow. On the other hand, it should also be considered that when migratory birds are seen flying seawards or coming from the sea, they do not always go to or come from land. During the *Fram* Expedition eider ducks and even flocks of land birds (*Phalaropus*) were seen in the North Polar sea in very high latitudes and far north of any land.

Legends of the Eskimo about Unknown Lands.—The Eskimo of Alaska and the American Arctic archipelago, as well as the natives of North-Eastern Siberia, have legends about lands to the north of Alaska and Siberia to which they have travelled, or from which they have come to the American Arctic coasts. Several authors have considered these legends to be important evidences that such unknown lands actually exist. Folklore is, however, of very little value for geographical discussions of this kind. The tales of folklore may wander over great parts of the Earth from one tribe to another, and they very frequently get some local colour in order to localize them in each special region. Tales of great lands far out in the sea, which are often unusually fertile and happy, are especially common amongst natives living on coasts. I may, as an example, remind you of the old legends of Great Ireland in the sea west of Ireland, and also those of a fairyland west of northern Norway. Sometimes certain features of these legends themselves indicate that they cannot have originated in the region where we meet them. This is, for instance, the case with the legend told by the Eskimo of Point Barrow about a hilly country to the north inhabited by people like themselves, to which some of their tribe were carried on ice broken up in a southerly gale. If such a land exists in the north it is at any rate ice-bound, and it is not probable that people

could be carried thither on an ice-floe; it is probable that the tale has come from coasts where the sea was more open. On some coasts the people are carried away to the unknown lands in drifting ships or boats, or—according to Greenland legends—even in a shoe. The traditions of land having been seen far out to sea are often equally untrustworthy, and have very often in the history of exploration proved fallacious.

The North Polar Problems of the Future.

I shall try to give a summary of what, in my opinion, are the most important North Polar problems now waiting for their solution.

1. *The North Polar Basin.*—I have already mentioned above that the most important feature of the geography of the North Polar regions is perhaps the North Polar basin, and the greatest deed of geographical exploration still to be done in the north is, therefore, without comparison, an exploration of the extension, depths, and general physical conditions of this deep sea basin. A great deal of this work could be attained by a new expedition like that of the *Fram* in 1893–96, drifting across the still unknown sea to the north of the *Fram's* track.

2. *The Edges of the North Polar Basin.*—The extension and shape of the north polar basin will have to be settled by exploration of its edges. The extension and configuration of the continental shelf north of the American Arctic archipelago and Alaska, as well as eastern Siberia, are, therefore, features of the very highest importance to get examined, as it would actually mean tracing the determination of what I would call the submarine coasts of the deep North Polar basin. The solution of this problem could only be attained by numerous soundings, and it would be of great value to examine at the same time the temperature, salinity, and, if possible, the currents of the water-strata at various depths over the shelf and beyond it. This great work must chiefly be carried out by sledge expeditions, which, however, is no easy task, as it is difficult to carry the necessary sounding equipment and instruments on sledges; but it can be done. Sir Clements Markham has already pointed out the Beaufort sea, north of Alaska, as a region where it would be of special interest at present to know the extent of the continental shelf. It would be valuable to know whether it is traversed by deep submarine fjords, whether the Beaufort sea is deep, and if so whether its basin is a part of the deep North Polar basin across which the *Fram* drifted. Some trustworthy observations of the temperature and salinity of its deeper water-strata would settle the latter question. The expedition under Einar Mikkelsen, on board the small sailing vessel the *Duchess of Bedford,* has set out to explore this region, and has spent last winter on the north coast of Alaska, where it may do important work already this spring, by a sledge expedition over the ice to the north. Another expedition under the

Englishman Harrison has travelled down the Mackenzie river, as far as I understand, with a similar object. Having no vessel, this expedition may probably meet with greater difficulties before it can reach its base of operations. But let us hope that both expeditions will be successful, and be able to penetrate into unknown parts of that sea in order to make their observations; they cannot then fail to bring home results of great value.

Any soundings in connection with some, even though few, trustworthy observations of deep-sea temperatures and salinities west and north of the Parry islands would be of great value, and might tell us much about the possible extension of the continental shelf and of possible land in that region.

The determination of the extent of the continental shelf to the north of Axel Heiberg Land and Ellesmere Land would be a great achievement. I understand that this will be a part of Peary's programme on his next expedition, and he is certainly the man to carry it out. A satisfactory solution of this problem would be of more scientific value than even the attainment of the pole. On the whole it should be kept in view that the extent and shape of the polar continental shelf, which means the real continental mass, is the great feature of north polar geography, which is of much more importance, geographically or geomorphologically, than the possible occurrence of unknown islands on this shelf.

3. *The Unknown Sea off North-east Greenland.*—An investigation of the depths and the various water-layers (their temperatures and salinities) in the unknown sea between northern Greenland and Spitsbergen, in connection with an exploration of the still unknown north-eastern Greenland coast, would be of very great value, especially as the solution of important problems connected with the oceanic circulation in the North Polar basin and the Norwegian sea might thus be finally solved. It would be of great interest to learn the extent of the continental shelf in that region, and whether a sub-oceanic ridge actually extends between Greenland and Spitsbergen, as seems probable, and what its form and depths are, etc. This is, however, a difficult region to reach, as it is generally blocked by heavy ice. Mr. Mylius Erichsen, who is now on the north-eastern coast of Greenland, had the intention of making an attempt to penetrate seawards from Greenland into this region with sledges in order to make soundings. We hope that he may succeed, and that he will also manage to explore the last part of the circumference of Greenland which is still unknown.

4. *The Channels of the American Arctic Archipelago.*—I have already pointed out that the geomorphological features of the American Arctic archipelago, with its remarkably great fjords and sounds, are exceptionally interesting. A systematical research of the depths and water-layers of these channels, as well as of the Baffin bay, cannot fail to give very

important results, and would be comparatively easy to carry out. A thorough research of the geology and tectonic structure of those islands at the same time would be of great value. The geological investigations carried out during the English expeditions, and during the late Sverdrup expedition, have shown that the geology of these regions has many features of peculiar interest also from a geomorphological point of view. As a few examples I may mention the various glacial phenomena, the glacial and atmospheric erosion, as well as the marine denudation of these regions. What is the origin of the great channels and fjords, and what is their history of formation? These are important questions about which we at present know little or nothing.

5. *The Interior of the Greenland Inland Ice* is still, to a great extent, an unknown region, which it would be of much scientific interest to get explored. The inland ice has been crossed in the south by my own expedition, and further south by Garde, near its northern termination by Peary, but in its central and broadest part it is still perfectly unknown. A crossing in that region with an investigation of its heights, its surface configuration, its angles of slope, the conditions of the snow in its interior, its nunataks, its climatic conditions, etc., would be of the very greatest interest in various respects, and would give an important addition to our knowledge of the Arctic Regions and their physical conditions. We may in that way obtain most valuable information as to the conditions which probably prevailed in the interior of the European inland ice during the Great Ice Age. It is a part of Mylius Erichsen's programme to cross the Greenland inland ice near its broadest. May he be successful!

Methods of North Polar Exploration.

Before I finish, I wish to say a few words about the methods of the north polar exploration of the future.

Sledge Expeditions.—There can be no doubt that sledge expeditions will remain the chief method by which great parts of the still Unknown North will have to be explored. The drawback with sledge journeys across the north polar ice, as they have hitherto been carried out, is, however, that they tell us very little as to the region traversed, except where lands or islands are met with. Unless they be specially equipped, they give very little opportunity of soundings and oceanographical work. A sledge expedition across the unknown North Polar sea, which can only tell us that this sea is covered with drifting polar ice, tells us very little new indeed. It may give us some photographs showing the appearance of this ice, which we know fairly well beforehand, and it may perhaps make some observations showing the drift of the ice during certain weeks of the year. But the results of such an expedition are certainly in no reasonable proportion to the time, energy, and money spent. We are no wiser as to the depths of the sea traversed,

or to its currents, and the physical conditions of its water-layers—nay, even the ice itself over which it travelled could not be properly measured and examined. I can here speak from sad experiences of my own. I regret still that, during Johansen's and my sledge journey from our highest latitudes southward to Franz Josef Land, we had no opportunity of sounding the sea over which we travelled, and not even to determine the northward extension of the continental shelf north of Hvidtenland. As another example, I may mention that the discovery during the *Jeannette* Expedition of De Long islands (*i.e.* Bennett island, Henrietta island, and Jeannette island) was naturally a discovery of much less scientific interest than the discovery of the shallow sea, *i.e.* the continental shelf on which these islands are situated, extending so far northward from the Siberian coast. The islands could have been discovered by a sledge expedition of the ordinary type, but the much more important feature of the submarine shelf might have remained unknown. By a practical equipment the sledge expeditions of the future can be made more useful. Light and portable sounding-machines with piano-wire, and light handy instruments for oceanographic research, can be constructed, and can be carried on the sledges. It might thus be possible to make most valuable observations, at least down to certain depths—say 500 or 600 fathoms—without very great difficulty. The depth and bottom of the sea should be examined, and bottom samples collected, which can easily be carried. The water-temperature at various depths should be observed. Most valuable observations of the velocity and direction of the currents at various depths could also be made without great difficulty by handy and portable current-meters. The ice is especially well adapted for making observations of this kind, and it might thus be possible to make most interesting studies of the tidal currents and the circulation currents of the sea, as well as the more irregular wind-drift of the ice and surface water in various parts of the Arctic Region. It might be more difficult to determine the salinity of the water-strata, owing to the low temperature of the air, which might make it difficult to prevent the water-samples from freezing. By hydrometers of total immersion and a glass cylinder in a double water-bath slightly heated by a small lamp, it would, however, be possible to determine the specific gravity of the most important water-samples at once on the ice. The determinations could be very exact, as the temperature of the water-samples could easily be kept fairly constant near zero Centigrade by using melting snow for the outer water-bath.

By plankton-nets of a practical pattern samples of the plankton from various depths of the sea can also be collected, and can easily be carried in small bottles with alcohol.

It is thus seen that even oceanographic exploration of a high quality may be carried out during a sledge expedition, if it be properly equipped for it, and the necessary time and weight be sacrificed for it. But this

kind of work is decidedly difficult to combine with the beating of records and the attainment of high latitudes, although it is perhaps much more interesting.

Another kind of valuable observation which could be carried out during sledge expeditions, even much more easily than the above mentioned, would be exact measurements of the thickness of the flat ice-floes and the height of the hummocks and pressure-ridges. The thickness of the ice-floes can easily be measured in newly formed cracks in the ice, either by a long bamboo rod with a hook, or also by a line with a lead and a horizontal cross at its lower end which catches under the ice. One has to try to find flat ice-floes which have actually attained their thickness directly by freezing, and which are not built up of thinner floes shoved on top of each other. It would be of great interest to learn, by numerous measurements of this kind, what thickness the flat floes can attain in various parts of the North Polar sea. Similar observations can also be made simply by examining and measuring the greatest ice-blocks piled up during very heavy ice-pressures, when even the thickest floes may be broken and raised on end. This method has the advantage that it is easy to examine the various layers of the ice and see whether it is composed of several floes. Observations of the probable age of the ice should also be made. Only by tasting the ice it is, for instance, easy to decide whether the ice is only one winter old (in which case it tastes very salt) or more. Its general appearance, as well as its strata near its under side, might also give indications as to its age. If it is in summer, and all snow on top is melted away, its more or less brownish dirty colour, due to dust and diatoms accumulated by the meltings of one or several summers, might give important indications. Samples of the dust and diatoms should be collected. If it is in regions where the snow on top does not melt entirely during the summer, but accumulates from one year to another, the snow strata should be carefully examined, as they might give information as to the age of the ice. According to my experience, it is, however, hardly probable that anywhere in the North Polar sea, there falls so much snow on the flat floes that it does not melt away in the summer. By numerous and exact measurements of the hummocks and ice-ridges—especially the newly formed, but also the old ones—in connection with measurements of the thickness of the blocks of which they are built up, it might be possible to get some idea of the comparative strength of the ice-pressures in the various regions of the north polar sea. Our knowledge in this respect is very defective at present; the descriptions tell, as a rule, only that hummocks are very great or partly enormous almost everywhere, and that is little to go by. It would be well to carry a special handy levelling instrument for this purpose, by which each measurement could easily be done fairly exact in a few minutes.

Sledge expeditions over the north polar ice, carried out on the system indicated above, would certainly be able to give us much important information of lasting scientific value.

Balloons and Airships.—Some people believe in airships of some kind for future North Polar exploration. But with the very imperfect control we have of these capricious means of locomotion at present, they would afford us little opportunity of making observations of much value. I have above pointed out the drawback in this respect of sledge expeditions dashing across the North Polar ice, but a balloon expedition sailing through the air, even if it can be carried out successfully, would give still poorer results, as it would hardly be able to tell us much about the regions traversed, even if the weather happened to be clear and the surface of the North Polar sea were not hidden from sight by fogs. The observations which could be made would be chiefly of meteorological interest. Experiments of this kind may, however, be interesting from other points of view, although I cannot see that the North Polar sea is a favourable region for making them, and I cannot help thinking that it would be wiser, and even more advantageous, to make such experiments in inhabited regions with more favourable climatic conditions, where a failure of the airship would mean less risks, and where failing machinery could be more easily mended.

Submarines.—It has also been proposed to use submarines for north polar exploration, diving under the ice and coming up in the open water-channels and lanes. This method would give excellent opportunity of exploring the unknown sea, if it were practicable. I do not think the chief difficulty would be to find sufficient open water to come to the surface in; but the submarine would have to go to a depth of at least 30 or 40 fathoms below the surface in order to be certain not to run into the under-side of the great hummocks; and this fact alone is, I am afraid, sufficient to make schemes of this kind valueless, at least for the present.

Ice-breakers.—Admiral Makaroff was of the opinion that strong ice-breakers would afford the best opportunity of exploring the North Polar sea. But even his excellent and very costly vessel, the *Yermak*, was no great success in this respect, and was not able to make much headway through the really heavy north polar ice. Even if sufficiently big and strong ice-breakers could be constructed to break their way through that ice, they would become so expensive that they would hardly be inside the limits of practical possibility. And besides there would always be the difficulty for ships of this kind to carry the necessary supply of coal for a long voyage through the ice.

Drift with the Ice in a Ship.—A practicable, and in several respects very advantageous, method of exploring the still unknown North Polar sea would be a drift with the ice in a ship sufficiently strong to stand the ice-pressures, as was proved by the *Fram* expedition. I strongly

advocated this method years ago, and shall not, therefore, go into detail here. I then pointed out that if the vessel entered the ice north or north-east of Bering straits, say somewhere near 160° W. long., she would be carried across the unknown regions of the North Polar sea, far north of the *Fram's* track, and after a period of about five years she would be carried out on the other side, near the north-east coast of Greenland. An expedition of this kind would give most important results, as there would be the most excellent opportunity of exploring thoroughly the physical conditions of the region traversed. With our present experience we should be able to give such an expedition a most perfect equipment of useful instruments for investigations of the sea at all depths, as well as the atmosphere in different heights (by kites), etc., and a perfectly unique material of important observations could be thus collected.

By the arrangements of Admiral George W. Melville, of the United States navy, and Mr. Henry G. Bryant, President of the Geographical Society of Philadelphia, about thirty-five specially constructed drift-casks were placed on ice-floes or cast adrift north of Alaska and Bering straits in the summers of 1899, 1900, and 1901, the hope being that valuable data concerning the speed and direction of Arctic currents might thus be secured. Only two of these drift-casks have again been heard of. The one was cast adrift on August 21, 1901, in 72° 18′ N. lat. and 175° 10′ W. long., and was recovered a year later near the mouth of Kolyuchin bay, on the Siberian coast west of Bering strait. This cask had evidently got a bad start, and, like the *Fram* during the first months of her drift, it had probably been drifted south by northerly winds, perhaps already during the first autumn. The other drift cask which has been recovered is, however, much more interesting. It was placed on an ice-floe west-north-west of Point Barrow, Alaska, in 71° 53′ N. lat. and 164° 50′ W. long. on September 13, 1899; and it was found six years later, on June 7, 1905, on the northern coast of Iceland, in 66° 31′ N. lat. and 16° 28′ W. long., where it had been drifted ashore. There can be no doubt that this cask has actually been drifted across the unknown region to the north of the routes of the *Jeannette* and the *Fram;* it must have taken very nearly the course I have proposed above. As we cannot know how long the cask had been lying on the Icelandic shore before it was found, or how long it had been drifting in open water near the Iceland coast before it was finally thrown ashore at this place, it is impossble to say how long the drift of the cask across the North Polar sea from its starting-point has lasted, but we know it must be less than five years and nine months. The probability is that the drift from the sea north of Alaska to the sea east of northern Greenland has not lasted longer than five years; and in this period a drifting expedition across the Unknown North may probably be finished.

Before the paper, the PRESIDENT: I have now to introduce to you His Excellency, Dr. Nansen. It is a work of supererogation, but it affords an opportunity of saying how sincerely we always welcome amongst us our distinguished Honorary Corresponding Member, and especially when, as to-night, he is good enough to give us, from this platform, the benefit of his experience and his thought. It seems almost yesterday that Dr. Nansen received from the hands of our former President, Sir Clements Markham, that special Gold Medal which our Society awarded to Dr. Nansen for his Polar Expedition. That award was ten years ago. It was about six years earlier that Dr. Nansen first came amongst us to receive our Patron's Gold Medal for his scarcely less memorable explorations in Greenland, which he was the first to traverse in its entirety. During those sixteen years our Society has learned to look upon him as in some way belonging to itself, and that feeling was, if possible, strengthened when His Excellency came to the Court of St. James's as the accredited representative of that old kingdom of Norway, of which the reigning sovereigns are so closely related to our own King and Queen. The sympathy of Britons with Scandinavia runs warmly in our blood, in which the Norse element is not only considerable, but also extremely active, as I think is evidenced in our maritime history and in our conquests beyond the seas, which recall the gallant actions of the Norsemen of the Middle Ages. But the affections of our Society for Dr. Nansen do not rest only on the fact of his being a hardy Norseman; they are based mainly on his remarkable personality, which cannot fail to impress itself upon all who come in contact with him. Among his many virtues is that of thoroughness, and in hearing to-night his address on Polar Problems we shall have the satisfaction of feeling that we are listening to one whose experience and thought in that direction are absolutely unrivalled. I now call upon His Excellency to give us his address.

After the paper, Sir CLEMENTS MARKHAM: We have all listened with great pleasure to this most interesting address. We are always glad to welcome our friend Nansen here, not only owing to our admiration for him, but because many of us regard him with affection. He never comes here unless his addresses contain something that is important and often that is memorable. He came here to propound his plan before his great expedition, and he met with a quantity of adverse criticism which all turned out to be entirely wrong, while what Nansen said was perfectly accurate and correct. He had studied the subject with very great care, and I am glad to say that I was not one of those to criticize him adversely, because I entirely agreed with him on every point. I was not present at the meeting. The next time that he appeared amongst us was after he had returned from that great expedition. He deprecates my saying that he then drew the veil from the Arctic mystery; but at all events we may say that he gave us entirely new ideas about Arctic problems. I have only time now to allude to what we ought to do in the future. He has shown us that if this continental shelf right round the polar basin was explored, we must necessarily discover all the undiscovered Arctic land. We should, therefore, turn our attention to this point. I regret that he was unable to dwell a little longer on the question of the driftwood, which I look upon as a most important one. If Colonel Feilden is present—there is no man who knows so much about it —I should like to hear from him his opinion as to where that driftwood came from, whether it was from America or Siberia, because that is a matter which must be taken into our consideration. We must remember now that it will be no use, geographically speaking, it will be absolutely of no use, for Arctic sledge travellers to attempt exploration without the means of sounding at least 100 fathoms. I discussed that matter very carefully with Mr. Mikkelsen, and he was deeply impressed with its importance. He will not take it for granted that he has come to the edge of the continental shelf when he finds no bottom at 100 fathoms,

because it is possible he may have come upon one of those submarine fjords or valleys, and he will always take care to make certain that he is not mistaken on that point. We may now, I think, look upon it as an axiom in Arctic exploration in future, that we must devote ourselves to the examination of the continental shelf. Indeed, I look upon what Nansen has said as having given us the watchword of the continental shelf. I thank him very much for the great interest he has given us this evening, and for the rich material for thought with which he has furnished us in his address.

Sir Archibald Geikie: Even if a geologist were disposed to criticize Dr. Nansen's opinions, his critical tendency would be apt to be silenced by his personal admiration of the man who displayed such marvellous endurance among the trials and dangers of the north, and who, since he returned safe and sound from these perils, has shown such a continued and enlightened interest in the subject of polar exploration and in inculcating the views to which his studies have led him. Listening, as I have done, with keen interest to what Dr. Nansen has said this evening, I gather that in the geomorphological part of his subject, he regards the most important problem to be the further investigation of the great sea-basin which he was himself the first to discover. In this opinion I am sure that most geologists will concur. He has referred a good deal to what he has termed the "continental shelf." I do not know that geologists generally would attach quite the same importance to that feature that he does. We are in the habit of regarding this continental shelf as a certain zone of instability where the relative levels of sea and land from time to time may vary, where the atmospheric agencies and the sea are at work, and where, in the course of ages, a certain more or less level platform has been cut out of the land. Whether the zone so eroded be a broad platform or a narrow one will depend partly on the angle of the slope of the edge of the continent, partly upon the length of time during which the continental margin has been exposed to denudation, and partly upon the nature and activity of the agents of destruction. In the case of the continental shelf of the polar basin, to which Dr. Nansen has referred, he spoke of the possibility of its formation having begun in Jurassic time. That may be true, though as yet we know little about the age of some of these great depressions on the surface of the Earth. But if the origin of this polar sea-basin started so recently as Jurassic time, the probability is that the terrestrial movements to which it was due have been continued in more recent periods. During the Tertiary ages some of the most voluminous volcanic eruptions which Europe has ever seen took place in our own region. It was then that the immense sheets of basaltic lava were poured forth, of which mere fragments are left in the Inner Hebrides, Antrim, the Færoe islands, and again in Iceland. The modern descendants and representatives of these volcanoes are not yet extinct; they are still vigorous in Iceland and Jan Mayen. Whether or not they have extended further north into the great polar basin remains to be discovered. It is quite possible, though the chances are perhaps against it, that if some future *Fram* shall direct its course right across the centre of that north polar basin, it may come across some volcanic vent still blazing away as Mounts Erebus and Terror are doing in the southern polar regions. Of the many important questions to which the lecturer has alluded this evening, that which to the geologist presents special interest is the further exploration of Dr. Nansen's great northern polar basin. We would like to have its margin traced, and to know by what kind of rocks it is encircled, whether or not it is one great basin, and whether from any part of its area a volcanic vent rises to the surface.

Colonel Feilden: Sir Clements Markham asks me to express an opinion from whence the driftwood found on the north shores of Grant Land and Greenland

is derived. It must come either from the Mackenzie and Coppermine rivers of America, or from the rivers of Siberia. The enormous beds of driftwood found by McClure on the west coast of Banks Land, and in lesser quantities on Prince Patrick island, are unquestionably the products of the American rivers. This wood from Banks Land was pronounced to be coniferous, and a cone to be identical with the present spruce pine of North America. During the passage of the *Investigator* along the west shore of Banks Land floating wood was seen. We may therefore assert with some confidence that the transportation of driftwood by the currents of Beaufort sea is still in progress, and must have continued for ages. Captain Amundsen kindly informed me that he met with no driftwood on the shores of King William island. This is explained, probably, by the Great Fish river emerging from extensive lakes north of the limit of tree-growth, and the currents drifting the Coppermine and Mackenzie wood to the westward into Beaufort sea. The problem that confronts us is, whether a current sweeps past Banks Land and Prince Patrick island, along the fringe of the yet unexplored North American archipelago, and deposits driftwood on the shores of Grant Land and North Greenland, or whether, diverted say at Prince Patrick island, it crosses the Beaufort sea and eventually joins into the *Fram* drift. The easterly drift met with by Peary north of Cape Columbia, and the drift tree embedded in the floe seen by Peary, are suggestive. On the other hand, can we doubt that the vast deposits of driftwood on the New Siberian islands and on Bennett island are products of the Siberian rivers, and following the track of the *Fram*, a large amount of driftwood must ever be passing across the polar area, some of which would be deposited on the north and east shores of Greenland, and presumably on Grant Land. Is it not possible that the ocean currents, in their vast gyrations within the polar area, may commingle the driftwood of the Asiatic and American rivers? We might gain some information from a careful examination of the drift-timber stranded on the north shores of Iceland. If it comes from the Siberian rivers, in all probability it is accompanied by the wooden perforated horseshoe-shaped net-floats used by the Russian and Samoyede fishermen of Siberia. I have found these along with great accumulations of driftwood on the east coast of Waigats, thrown up by the Kara sea. There is another interesting drift to be met with on the north shores of Grant Land and North Greenland. I refer to the ice-rafted erratics of granite, syenite, and archaic rocks, which are to be seen from present shore-line to high elevations in those regions. None of these rocks are known in North Greenland, nor in Grant Land, nor in Ellesmere Land north of the 79th parallel, nor in any of the islands of the North American archipelago yet discovered. It seems to me impossible that these erratics could have been translated by the ice-floes from Baffin bay, or up Smith sound to the shores of the polar ocean. The question is, From whence do they come?

The PRESIDENT: The hour is now so late that I must propose the usual vote of thanks to Dr. Nansen, and ask him if he has any remarks to make upon the discussion.

Dr. NANSEN: It is so very late that I am afraid I must not detain you very long. But there are a few things I should like to say a few words about. As to the possibility of unknown volcanoes in the north, I may mention one thing which might speak in favour of Sir Archibald Geikie's views. On the coasts of Norway there are found great quantities of two kinds of pumice-like stones, which have been examined by the Swedish geologist, Dr. Bäckström. The one kind is not real pumice-stone, but is iron slag thrown into the sea by some of the Scotch ironworks. The other kind is, however, real pumice-stone of a peculiar nature, it being composed of andesitic rocks. As no known volcanoes on this side of the North Pole

produce pumice-stones of this composition, it was assumed that they must have come from the volcanoes in Alaska; and as great quantities of them are found near old post-Glacial shore-lines high above present sea-level, it seemed probable that there had been a regular drift of these pumice-stones with the North Polar current across the North Polar sea from Alaska during previous post-Glacial times. There is, however, a possibility that they have not come from Alaska, but from some unknown volcanoes in the north producing andesitic lavas. With regard to the driftwood, I should like to have heard Colonel Feilden say still more about that subject. The great quantities found during the Nares Expedition on the coasts of Ellesmere Land interest me especially very much; some was found at heights of even above 150 feet.

Colonel Feilden: Found at 1800 feet.

Dr. Nansen: That is very high indeed; and it may be that the wood found there has to be considered more as fossil wood. But, at any rate, comparatively modern driftwood is found high above present sea-level, and the wood cannot have been lifted to its present situation by ice-pressures or in any other way from the present shore-line. These pieces of old driftwood must have been drifted ashore during previous periods when the sea was nearly as much higher as the land where they are now found. And as there seems to be much driftwood of this kind, the probability is that the sea was then more open than it is now, because when the coasts are ice-bound, like the northern coast of Ellesmere Land is to-day, then we cannot expect much driftwood to be thrown ashore. I think the study of that driftwood is most important from a geological point of view; it may give valuable informations about the changes of sea-level or the shore-line in that region, and when there was a milder climate in the north, with more open polar seas. Perhaps those milder periods were simultaneous to the similar ones we have had in Europe in post-Glacial times, and evidences of which have been found in Norway, Sweden, Spitzbergen, and even Franz Josef Land. At that time our coasts were also somewhat more elevated than they are at present; but the elevation, at least at some places in Scandinavia, was then hardly more than 20 feet and less. It was, consequently, very little compared with the elevations mentioned in Ellesmere Land. I entirely agree with Colonel Feilden as to the origins of the driftwood, and I think that in those regions it chiefly came from Siberia, and it proves that not only at present, but also during previous geological times, there has been a continuous drift across the North Polar sea from the Siberian side towards the Greenland side. I wish, before I sit down, to use this opportunity of thanking you for your kindness, and the way in which you have received me and patiently listened to my lecture, which was very long, I am sorry to say, but I have the fault, I know, that when I begin a subject I have difficulty in giving it up again.

LORD CURZON ON FRONTIERS.*

By Colonel Sir T. H. HOLDICH, K.C.M.G., K.C.I.E., C.B., D.Sc.

No subject that could have been selected by the Chancellor of the University of Oxford for the Romanes lecture of 1907 could have been more appropriate than that of "Frontiers." As Lord Curzon remarked

* "The Romanes Lecture, 1907. Frontiers." By the Right Hon. Lord Curzon of Kedleston, D.C.L., LL.D., F.R.S., Chancellor of the University. Oxford: Clarendon Press. 1907.

at the commencement of the address, "It is a remarkable fact that although frontiers are the chief anxiety of nearly every foreign office in the civilized world, and are the subject of four out of every five political treaties or conventions that are now concluded, though as a branch of the science of government frontier policy is of the first practical importance, and has a more profound effect upon the peace or warfare of nations than any other factor, political or economic, there is yet no work or treatise in any language which, so far as I know, affects to treat of the subject as a whole." And it is certainly not less remarkable that a subject which is so intimately and inseparably connected with the study of physical geography should be treated officially as if it were an academic science based on certain fixed rules requiring no practical or even theoretical knowledge of the infinitely varied conditions out of which frontiers are evolved. Oh that Lord Curzon would write that book! Considering the range of information, historical, geographical, legal, and military, which that volume would embrace, it is marvellous how much of it he has succeeded in outlining in the "tabloid" which he offered for "passing consumption" in the Sheldonian theatre! His allusions to "frontiers in history" are sufficient to indicate the wide range of interest which surrounds this one branch of his subject. Commencing with the Farthest East, where there winds through plains and over mountains the Great Wall of China, he leads on to the classical mounds and ditches with which ancient Greece and Rome essayed to stay the approach of barbarian hordes, and passes finally to the Far West, where Canada was cut off by a ridiculous graticule-line, independent of all geographical considerations, from the rest of North America. Incidentally the story of our own frontiers, the Scottish borderland, is touched upon in eloquent terms—those marches which were watched by Marcher lords who "interwove a woof of chivalry and high romance into a warp of merciless rapine and savage deeds," and left behind them "a history which is written on the battered castles and peels of the Border, and enshrined in a literature of inimitable charm." All this is very alluring, but to do such a subject justice one would require the pen of Scott or Macaulay allied to an analytical faculty sufficient to deal with the practical issues of everyday frontier-making in the over-sea regions of the Empire. Only Lord Curzon can command such a combination.

It is, however, the practical side of the lecture which offers most opportunity for remark. Very clearly Lord Curzon draws the necessary line between the processes of delimitation and demarcation in settling a frontier on modern scientific principles, pointing out that the delimitation is the work of treaties and political authorities, and the demarcation falls to the lot of the geographer and engineer. There is, indeed, a great difference between the official or armchair settlement of a line on the basis of a map (or no map, as the case may be) and the process of defining that line by artificial means, or by the adoption of natural

features *in situ*. It is the latter process which leads to local discussion, delay, and dispute which may even terminate in a war, unless the framers of the delimitation are well advised as to geographical detail, or else are content to leave geographical detail entirely alone. Lord Curzon does not omit a reference to the danger of using loose geographical expressions—such as "the foot of the hills," for instance—in boundary treaties. It is the use of such expressions, as a matter of fact, which lands the demarcator in his most difficult situations. And he wisely refers to the inconvenience, expense, and frequent futility of the adoption of straight lines for frontiers, whether they be co-ordinate lines, such as parallels and meridians, or any other straight lines requiring artificial demarcation in waste places. With the infinite detail of demarcation methods, however, it is, of course, impossible even to deal in general terms within the compass of a Romanes lecture. It is a branch of the subject which much wants skilful literary illustration, and the enormous amount of experience gained of late years would furnish material for a very complete volume.

If anything, perhaps, the value of mountain ranges and great water-partings for the political division of nations might appear under-estimated in Lord Curzon's lecture. It is true that great mountain systems do not always divide great river-basins. In fact, the rivers traverse the mountains more often than not; but so long as mountains last they will present the most impassable and recognizable form of barriers that the geographical world has to offer, and the fact of the rivers passing through them (so long as the possibility is recognized in treaty delimitation) hardly affects their value as frontiers. It was imperfect information as to the geographical conditions of the southern Andes which led to the dangerous dispute between Chili and Argentina (a dispute, by the way, which was settled by the award of King Edward VII., and is not alluded to by Lord Curzon, although he mentions the King of Sweden and the King of Italy as arbitrators), but for nearly 2000 miles that great mountain system now parts the two countries. The "Snowy" range of the Himalayas is none the less effective as the northern frontier of India because it is broken by the Indus and the Brahmaputra. Nor is it only the more important mountain systems of the world which afford good lines of political division; even minor water-partings are most useful, inasmuch as they so frequently require no artificial definition. Boundary pillars are ephemeral, and pass away, but the everlasting hills will, at any rate, outlast our own geographical era. Artificial definition is always slow and costly, and it is frequently dangerous likewise from the local dispute which arises during the protracted delay of demarcation. To pillar up a line through a desert, for example, is a futile waste of money, and Lord Curzon does not fail to indicate the value of the desert barrier without such demarcation. He calls attention to the

enormous extent of boundary settlement which has occupied British surveyors in late years. This may be estimated from the fact that in Africa alone, up to July in the present year, no less than 9250 miles of frontier had been laid down. There are now no "Hinterlands" in British Africa, and very few in India, so that it is difficult to say where this particular branch of frontier making is to maintain a future existence.

The lecturer refers to South America as a country with its boundaries mostly settled, but there is, as a matter of fact, still much to be done in that continent. Peru and Bolivia have not yet rounded off their common frontier, and there is even a vague dispute between Argentina and Paraguay as to respective spheres of influence. South America may yet again appeal to that great principle of arbitration, which is the dominant feature of modern frontier settlement.

The eloquence of the Chancellor's final appeal to his university to take its share in the stirring episodes of frontier life is worthy of one of England's best orators. No one who has breathed the breath of the frontier hills of India, and who has lived amidst the life of the old historic races who people the borderland, and who still retain much of the chivalry and the savagery of the Scottish marches of three hundred years ago, can fail to respond to the enthusiasm of India's late viceroy, when he wakes up the echoes of past achievements, and speaks of that unresting frontier, where the touch of his own hand was so often and so clearly felt, and which must have been to him the most alluring of his Indian studies, the most thorny of the many great problems which he lived to solve.

CAPTAIN PERCIVAL'S SURVEYS IN THE BAHR-EL-GHAZAL PROVINCE.*

We issue with the present number a map of the western part of the Bahr-el-Ghazal province, being a reduction from the original route surveys executed in that region during 1906 and 1907 by Captain C. Percival, of the Rifle Brigade. Captain Percival has been one of the most active of the British officers whose surveys have for the first time supplied a basis for the detailed mapping of the province, while at the same time helping to throw light on its hydrographical system. The main outlines of this had been known to geographers through the journeys of Lupton, Junker, and others, but many points of detail remained obscure, especially in regard to the lower courses of the streams draining the north-west part of the province, which the earlier journeys of Captain Percival (in association with Lieut. Bayldon, R.N.) did much to elucidate. This officer was unable, during his short stay in this country previous to returning to his post, to prepare an account of

* Map, p. 692.

his journeys, but he has placed his route-books at our disposal, and these enable us to put together some notes on the country traversed, although the bulk of the material consists of minute details unsuitable for reproduction in full. Among other points the journals give careful information on the size and rate of flow of the rivers, the height of their banks, the extent of inundation in the rains, the position of fords, the spots at which Government ferry-boats are maintained, and so forth. The altitudes, as determined by aneroid, are recorded throughout, and though the absolute values are of course not to be depended on, they give a useful idea of the variations of the surface. An estimate is also given of the altitude of the hills seen on the route, which in general appears to vary from 3000 to 4000 feet, though occasionally approaching 5000. Detailed information is likewise given as to the size of the villages, the names and comparative influence of the native sultans and sheikhs, the distribution of the tribes, the positions of the Government posts, and so forth, while the occurrence of the tsetse fly is noted wherever observed.

The first journey led from Deim Zubeir, the temporary headquarters of the western district, *viâ* Ragaa, Gebel Miggi, and Kafiakangi, to Hofrat en Nahas, the site of the old copper workings on the southern borders of Darfur. The start was made on May 21, 1906, and, the rains having commenced, some of the rivers were full and unfordable, though most had not reached a high level. Many, even of the smaller khors, contain water all the year. In the southern section, the greater number of the villages were inhabited by various sections of the Koreish (Kreish or Krej). Ragaa, the residence of Sultan Musa Hamed, is the largest place in the district, consisting of 400 to 500 houses, the people here being Ferogeh from Darfur. Between the Ragaa and Boro rivers the path reached a summit level of 2900 feet; a sharp drop then commencing towards the Boro.

The village of Sultan Miriki, on the right bank of the latter, is one of the best in the district, the people (Koreish Aja) being happy and well favoured. That of Sultan Said Buldas, one and a half days from the source of the Boro, is described as an excellent site for a station, as is also the village of Sheikh Seleman, on the right bank of the Boro. At about 36 miles from Sultan Said Buldas the path makes a steep descent of 600 feet in three-quarters of a mile, being here impracticable for loaded animals. From Sheikh Hamdan's—a healthy site free from tsetse—a fine view to the north and west was gained. Gebel Miggi lies about 3 miles to the east of this. Kafiakangi, about 32 miles beyond, is a Government police post, for a time the residence of Sultan Ibrahim Murad. A little to the south is the trading centre of Guku, visited by merchants from the Congo, Darfur, Kordofan, etc., the principal articles of commerce being ivory, rhinoceros-horn, and calico. The people are Furtit and Koreish. At Kafiakangi sandy ridges alternate with swampy,

black ground, water being found all the year a few feet below the surface, as well as in holes in the bed of the Vungo. At 9 miles beyond, the country changes its aspect, the forest ceasing, and giving place to an open grass plain, on the far side of which runs the river Obo (Adda of the Arabs).* When this is full, all the plain is covered to a depth of 2 feet. It is dry in summer, with the exception of pools containing fish, crocodiles, and hippo. On the adjacent flats game was abundant, and buffalo and rhinoceros were seen in the neighbourhood. The present residence of Sultan Murad is on the Umbelasha, which also floods most of the country when full, though Captain Percival seems to regard the Obo or Adda (which, he was told, rises a long way to the left of his route) as the main headstream of the Kir, or Bahr-el-Arab. At the time, the Umbelasha was very muddy and of the size of the Avon at Tewkesbury. Hofrat en Nahas lies some 4 miles further up-stream.

The copper-mines of Hofrat en Nahas (visited by Purdy in 1876) have not been worked for over twenty-five years. There are two large holes called Om (mother), the larger 15 feet deep, with smaller pits scattered about. The reef extended over a space of 600 by 300 yards and no further. There is a depth of about 15 feet of earth and rock (dark coloured where exposed) with no ore, and below this about 10 feet of copper-bearing reef, followed again by unproductive gravel or rock. Branch galleries, now filled up, afforded access to the ore, which was smelted over charcoal fires and made into round pieces about a foot across and from 1 to 2 inches thick. The reef was found accidentally by men who were searching for iron ore, and was worked by the Furtit people for the father and grandfather of the present sultan, who himself retired before the Dervishes to Kafiakangi. The copper is said to have fetched a high price in the Fur country and at El Fasher.

Returning to Kafiakangi, Captain Percival went east and south-east to Kabaluzu and Kossinga. The former is a great trade centre, being a meeting-point of roads from the Congo, Darfur, and various parts of the western Bahr-el-Ghazal district. It is the residence of the influential Sheikh Gadud (a subordinate of Sultan Musa Hamed), who brought the name with him from his former residence. One day north there are Mandala villages and iron-workings, and the Adda or Bahr-el-Arab is from one and a half to two days off. The people, who are very mixed (Ferogeh and other tribes), get water from the bed of the khor; but it is bad, and an epidemic broke out in 1906. A police post has been established during the present year. Between this and Telgona, the boundary between the domains of Sultan Musa Hamed and Sultan Nasr Andel is crossed. The people are Ferogeh, Mandala, and at Telgona mostly Ngunguleh. The Boro, where crossed *en route* to Kossinga, was 80 yards wide, and full

* In a note on his map, Captain Percival expresses a doubt whether the Adda is not a distinct river from the Obo.

to its banks, but fordable. Kossinga, the residence of Sultan Nasr Andel, contains 300 to 350 huts. The sultan is the most civilized and enlightened man in the western district, though Kossinga cannot compare with Ragaa in size. There is a small daily market, and the place does some trade, being visited by Gallaba (Sudanese merchants). The people are Ngunguleh. Captain Percival went south from Kossinga to Deim Zubeir, where his aneroid on arrival read 2620 feet as against 2590 given by former observations.

Early in 1907, Captain Percival surveyed a longer route from Deim Zubeir by way of Gebel Zakka to Ragaa, to which the headquarters of the western district were transferred at the beginning of the year. His latest routes led from Ragaa to Kossinga and thence back to Deim Zubeir; and from the latter north-east to Chakchak, a Government post near the residence of the Dinka sultan of that name.

A few general notes on the nature of the country may be reproduced in conclusion. All the western district is forest, sometimes in the form of large trees. Much rubber occurs on the Congo side. South of a line through Kafiakangi, Kabaluzu, and Telgona the country is undulating, in large folds, the soil being red and sandy, so that it dries quickly. Further north the surface is flatter, with black mud and swamps. Towards the western frontier there are many hills, but these are scarce elsewhere. In the rains the country is choked with spear-grass eight feet high. Nearly all the rivers flow through grass plains, liable to inundation. The tsetse fly occurs almost all over the district, often very badly. The western district is the only part of the Bahr-el-Ghazal which contains Arabic-speaking peoples of Arab extraction. They do not, however, dwell south of the line through Telgona, Kossinga, Ragaa, and Kafiakangi-Guku, and all seem to have come south from Darfur within the last 30 years. The Arab line would appear to continue into French territory west and north of Kafiakangi. The Koreish and Banda are low-typed, unenlightened people, the latter having the finer physique. The Mandala elephant-hunters are a mixture of every type, being probably composed partly of revolted Arab slaves.

SURVEYS ON THE MOZAMBIQUE COAST.*

A USEFUL piece of work has been done by Mr. Carlos Usseglio, a land surveyor in the service of the Companhia de Moçambique, in the survey of the strip of coast between Beira and the delta of the Zambezi. Strange to say, this portion of the coast, though so close to one of the main gateways into the interior of South-East Africa, had never before,

* Map, p. 692.

apparently, been subjected to any sort of accurate survey, but has been shown, even on the latest Admiralty charts, with complete vagueness, any rough indications of its contours and nomenclature inserted therein now proving very different from the reality. Mr. Usseglio—a short account of whose operations, together with a blue-print copy of his original map, has been courteously placed at our disposal by the Mozambique Company—is said to be an expert surveyor, and as he covered the whole strip in question with a network of triangulation, and connected his work with fixed points at the two ends, his map, a reproduction of which we print in the present number, may be taken as giving a sufficiently accurate idea of the main features of the coast.

It will be seen from the routes shown in the map that Mr. Usseglio did not confine his attention to the coast-line itself, but made frequent *détours* inland, and was able to lay down the courses of the various small streams that drain this area. No great interval, in fact, separates his work from that of Mr. R. L. Reid, whose map was published in the *Journal* for January, 1905. The Nyamonga range, which forms the water-parting between the basin of the Pungwe and the coast streams above alluded to, was not, however, crossed by either traveller, and Mr. Usseglio's map marks the country in this direction as merely undulating.

Considerable difficulties seem to have been encountered in the execution of the task, owing especially to the scarcity of fresh water in the vicinity of the coast, the rivers becoming brackish through the influence of the tide, so that it was sometimes necessary to bring the needed supply from a distance. The crossing of the rivers also presented difficulties, and, besides this, Mr. Usseglio's native followers gave some trouble, so that it says much for his energy and determination that he was able to complete the survey in the short space of two months. This was only accomplished by frequently working without a rest from 5 a.m. to 5 p.m., and it would have been impossible at any but the coolest time of the year, when the natives drink little, thus lessening the difficulties of the water-supply. Another fact which favoured the rapidity of the work was the frequent occurrence along the coast of casuarina trees, which, being visible for long distances, could be utilized as points in the triangulation.

In making his way northwards from Beira, Mr. Usseglio was able to ford some of the rivers at low water, though boats were sometimes available. Thus the Savane was crossed in fishing-boats belonging to a company established there. This river forms a large lagoon parallel to the coast, and at certain points it is separated from the sea, at high water, merely by a line of dunes. Casuarinas begin to appear between the Savane and the Senga, and are scattered over the whole coast-line northwards as far as the Nyamisembe. Their seeds would seem to be transported hither by the tide. Near the Senga the dunes (which seem

to characterize all this coast) were very high, and presented the appearance of a ruined castle. Fresh water was found at their foot on the landward side. At Teu Teu, some distance inland, two white men were met—the company's administrator and a trader named Silva. On leaving the coast, herds of elephants were constantly seen, and hippopotami in the rivers. A native village was found on the estuary of the Nyamisembe, and the chief supplied boats for its passage. A wide "tando," or flat, extends from the Nyamisembe to the Mupa, separated from the sea only by a line of dunes and palm trees. Game abounds on it, and many lions and leopards were also seen. The crossing of the Luana, near which the Luabo company has two establishments, was somewhat perilous owing to the strength of the current.

The return was effected by the same route as far as Teu Teu, the path traversing a generally flat and sandy country covered in part by forest, which at one spot was particularly rich in rubber plants. From Teu Teu (where a market is held), the journey was continued by an inland route to Loforte, over very similar country to that traversed by the railway during the first 28 miles from Beira. The road from Loporte to Beira followed by Mr. Usseglio was found to have fallen into complete disuse.

TRAVELS IN GERMAN, BRITISH, AND DUTCH NEW GUINEA.

By Dr. RUDOLF PÖCH.

My two years' journey in German, British, and Dutch New Guinea in the years 1904–06 began with a four months' stay among the Monumbo (Potsdam harbour), on the north coast of German New Guinea. In the company of the missionaries there, I wandered into the Hinterland to the tribe of the Alepapun, as far as the village of Arimesi. The land is hilly, of coral rock, with steep slopes; only in its watercourses do you find bush, everywhere else is grassland. My next visit was first to the Iku mountains, a chain about 1200 feet high to the west of the Monumbo mountains, and then to the opposite island of Manam, with the 3000-feet-high volcanic mountain.

The main object of my investigations was the tribe of the Monumbo. I made, however, acquaintance also with all the western peoples to as far as the mouth of the Empress Augusta river, where I visited the Vatám, as also the Manam and the inland dwellers, Alepapun and Zepa.

The most important events during my stay were great dancing festivities with masks and songs among the Monumbo; the "Udsuangong" and "Zangal" dances before the beginning of the rainy season; next an outbreak of the volcano on Manam on October 24, 1904, which ejected its lava into the sea.

The results of my labours among the Monumbo may be summarized as follows:—

1. The Monumbo are a tribe of tall coast Papuas, with very long upper extremities, meso- to brachy-cephalic, long-faced, and showing the typically curved Papuan nose. An allied type dwells along the whole coast to the Augusta river, but they are meso- to dolicho-cephalic.

2. The Monumbo are a tribe numbering some five hundred, who, as a rule, marry among themselves, yet I failed to establish any inbreeding.

3. In their masks and dances they imitate animals, but have no further trace of totemism. The food prohibitions in force are not totemic.

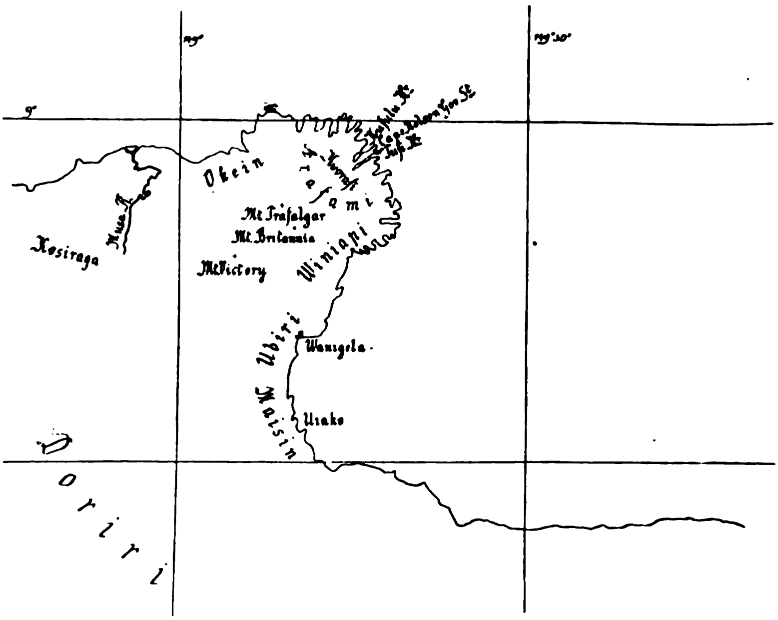
4. According to Prof. W. Schmidt's elaboration of the notes of missionary F. Vormann, their language is purely Papuan.

5. Only a few old men know the traditions of the people and are able to explain the ornaments.

6. For various industrial products there are centres, whence they are traded into farther regions.

7. The traditions for dances and songs come from the west.

8. The text of the songs is unintelligible to the people themselves, and is probably derived from an unknown, possibly an extinct, language.



TRIBAL MAP OF CAPE NELSON.

My travels further comprised a two months' stay among the Kai on the Sattelberg at a mission station; a five days' wandering with Kai people into the Hinterland of Finch haven; a twofold crossing of the upper course of the Bubui, there called Mape, and of two hitherto unknown western affluents, Hu and Hopi. The march proceeded through very rugged mountain land covered with primæval forest, the mountain ridges we climbed being over 3000 feet above sea-level. On the slopes of the river-banks the land is thickly populated, but further to the interior the population is very scanty. The rocks are coral; overlying it is chalk, besides sandstone; in Mape there are quartz boulders.

The Kai are a mountain tribe of strong, squarely built people, meso- to brachycephalic, with faces not long, but angular; their average bodily stature I found to be 5 feet among the men. What is remarkable is a pretty considerable percentage of short people, measuring among the men 4 feet 4 inches. Have we here a species of a dwarf race? The language is purely Papuan; the vocabulary collected by Keysser has partly been elaborated by Schmidt.

The land of the Kai is divided into districts. Within the same district there wander village communities, who every year change their place of plantation and frequently at the same time their place of settlement.

ANCIENT POTTERY FOUND IN EXCAVATIONS AT WANIGELA, COLLINGWOOD BAY.

UIAKO, PAPUAN VILLAGE, MAISSIN TRIBE, COLLINGWOOD BAY.

The Kai possess a rich store of songs, whose meaning is still understood by them. The missionary Keysser is engaged in collecting and translating the poems, proverbs, and sagas.

Among the Poum, dwelling in the mountains inland from the Kai, fire is obtained by rubbing rotang on a cleft piece of the branch of a tree, bast serving them as tinder. I have followed up the distribution of this rarely recorded method, and have found a very recent record by C. A. W. Monckton in the mountains of New Guinea, in addition to two older accounts: one from the Negritos on the Philippines, the other from the Semangs in Malacca.

The investigations among the Kai suggest that further investigations should be undertaken in order to determine the relation of the undersized inland tribes of New Guinea to the Negritos.

In consequence of the massacres of the missionaries in St. Paul (New Pommerania), four Baining people were shot, and a greater number have been captured. This anthropological material, handed over to me for investigation, afforded my acquaintance with an apparently very primitive race, to judge by skull and skeleton. The skulls are strikingly meso- to brachy- and even hyperbrachy-cephalic, and the nose is broad.

My next field of work was the middle part of New Mecklenburg. The island is here so narrow that it may be crossed in a few hours, or at most half a day. The crest of the chain of mountains is nearer the south-west coast, and about 1300 feet high. There are a few rivers running a north-easterly course, and ending, after a short run, in a marshy estuary. In the upper course of one is a waterfall 150 to 180 feet high. The land is copiously watered. It is striking to find immediately on the seashore many fresh-water springs. The coast is of coral formation, and in the state of elevation. On the north-east coast, to the south of the village of Belik, I observed a second raised beach.

The inhabitants of Laur present a Melanesian type, and speak a language having affinity to that of the Gazelle peninsula. They have a totemistic system of two classes and matriarchate. There is a favoured class, protected by its stronger totem animal.

From German New Guinea I proceeded to Australia, and in Clarence district met the aboriginals of New South Wales. With their smooth hair, their strongly projecting orbital arches, the often deeply sunken nasal notch, and their broad, flattened noses, they presented a type in marked contrast to that of the Papuans.

In British New Guinea, now called "Papua," I stayed two months and a half on the north coast at the Government station of Cape Nelson, and a month on the south coast at Port Moresby. The region of Cape Nelson is volcanic. The three cones, Mount Victory, Trafalgar, and Britannia, are ranged close together. They have ejected immense lava-currents into the sea, which now lie spread out like the fingers of a hand, and between the fingers are deeply cut bays with steep banks. With the resident magistrate, G. O. Manning, I visited Collingwood and Goodenough bays. In Wanigela I prosecuted excavations which had been started by C. A. W. Monckton. Like him I found a carved shell, and pottery of a higher perfection than that now extant in this region. The beautiful ornaments are foreign. There is no tradition as to the people who produced this pottery. In the heap of *débris* I found a dolichocephalic skull. It is difficult to give any satisfactory account of this discovery. The account that most readily suggests itself would be to assume that a tribe migrated hither from the sea, and that this people were either driven back over sea or annihilated by the mountain tribes.

In Goodenough bay two different types of house-building are in close juxtaposition: houses on piles, built by the Papuan inland tribes; and houses resting immediately on the ground, built by the immigrant Melanesians of the D'Entre-Casteaux islands.

On Mosquito island in the same bay there are many particularly large hills of

HILL OF THE MOUND-BIRDS (MEGAPODIUS), MOSQUITO ISLAND, GOODENOUGH BAY.

GRASSLAND NEAR BOIANA, GOODENOUGH BAY.

the mound-birds (*Megapodius*), which have been piled out of coral sand to over a man's height by these fowls as hatching-ground for their eggs.

On the south shore of Goodenough bay, in the neighbourhood of Boiana and further west, there stretches grassland, a rare sight in these rainy parts of New Guinea. As far as my observation goes, it is only in those parts in which there is an altogether bad coral soil porous to the passage of water that, as a matter of fact, forest has never grown there. No doubt primitive forest is sometimes extirpated by the Papuans themselves hewing it down and converting it into plantations, and afterwards burning down the grass and the germs of aftergrowth. Otherwise, however, primitive forest, as a rule, covers all the rainy part of New Guinea; grassland is the rare exception.

The investigation of the Korafi near Cape Nelson led to the following results:—

1. They must be taken as a mixed Papuan and Melanesian race.
2. Their language is probably not pure Papuan.
3. They are meso- to dolicho-cephalic.
4. They have a totemic system fallen into decay.

Tapa is made with considerable skill, and painted freely with vegetable colours in very tasteful patterns. There are beautiful dances for which head ornaments (not masks) are worn.

In celebration of the king's birthday, the resident magistrate, G. O. Manning, invited the natives of the North-Eastern Division to dances at the Government station at Cape Nelson. Some 700 men came, among them many who had never before been in Cape Nelson. I admired the great influence which the Government there, in scarce five years, had acquired over a territory as large as my native land of Lower Austria, and inhabited by Papuans who, from immemorial time, had lived in tribal fights and man-hunting.

I succeeded here in getting a series of cinematographic photographs. The dance figures are beautiful and well arranged, and the people are still in their original costume.

As personal guest of the governor of British New Guinea (Papua), His Excellency Captain F. R. Barton, I was brought from Cape Nelson round East Cape to Port Moresby, where I was witness of the arrival of the great Lakatoi of the Motu people, the composite sailing-boats on which they yearly bring in sago from the Gulf of Papua. The Koita people and their customs are the subject of investigation by Prof. A. Haddon and Dr. Seligmann; I will only mention that here, too, I obtained rich booty for the cinematographs and phonographs of the Imperial Academy of Sciences in Vienna. Lastly, on the Government steamer *Merrie England*, I was conveyed to Thursday island, whence the Dutch gunboat *Valk* carried me over to Merauke.

The territory around Merauke, in Dutch South New Guinea, is a completely flat alluvial land, where no trace of an elevation is visible. From the sea you perceive a green strip of bush reaching almost to the water; in front of it the bright sand and the white surf on the shallow beach. There is nothing to interrupt these two thin parallel strips. Between Merauke and Fredrik-Hendrik island there discharge several large rivers. Rather large sea-ships can enter the Merauke river.

I next visited the Koembe and the Bian rivers. The latter I ascended with the Government official, and came into a hitherto unknown territory. The river turned sharply to the east, and we approached the Koembe. The natives say that in their upper course these rivers are confluent, a statement having some probability in its favour. The soil is sandy, but clayey in the neighbourhood of the river-mouths. Nowhere in this region did I notice any stone.

The natives are notorious head-hunters; they are called Tugeri, or Kaya-Kaya

NATIVE DANCE AT CAPE NELSON (PART OF A CINEMATOGRAPHIC PHOTO).

YOUNG MEN AND BOYS OF THE TUGERI TRIBE (KAJA-KAJA), DUTCH NEW GUINEA.

Formerly they extended their men-hunts eastwards on the other side of the Bensbach river. The British entered a protest with the Dutch Government, and, to keep the natives in check, the Dutch Government founded the Government station of Merauke. At first this station was in ill favour in consequence of beri-beri, which the Malays and Chinese had brought over with them, but now, in spite of its swamps and an enormous plague of gnats in the rainy season, Merauke is a healthy place, and, what is more remarkable, it is quite free of malaria.

My investigations respecting the natives yielded the following:—

1. The Tugeri (Kaya-Kaya) are a very tall type of coast Papuans, mostly dolichocephalic.
2. Poultry, salt, and pottery are unknown to them.
3. Their luxuries are tobacco ("tamuku," of Malay origin), betel, and vati—a kind of kava.
4. They go adorned mostly with trophies of the chase. Only the women have a covering round the loins.
5. They do not live in families, but the men, including those that are married, sleep in men-houses at the ends of the village.
6. The houses stand on the ground.
7. The Tugeri have a complicated totemic system, comprised of plants and animals, with head groups and subdivisions.
8. The totem is hereditarily transmitted through *the father*.
9. They have mask-dances, initiation ceremonies, with a ceremony of regeneration, but no circumcision.
10. They have bull-roarers.

RUWENZORI AND ITS LIFE ZONES.*

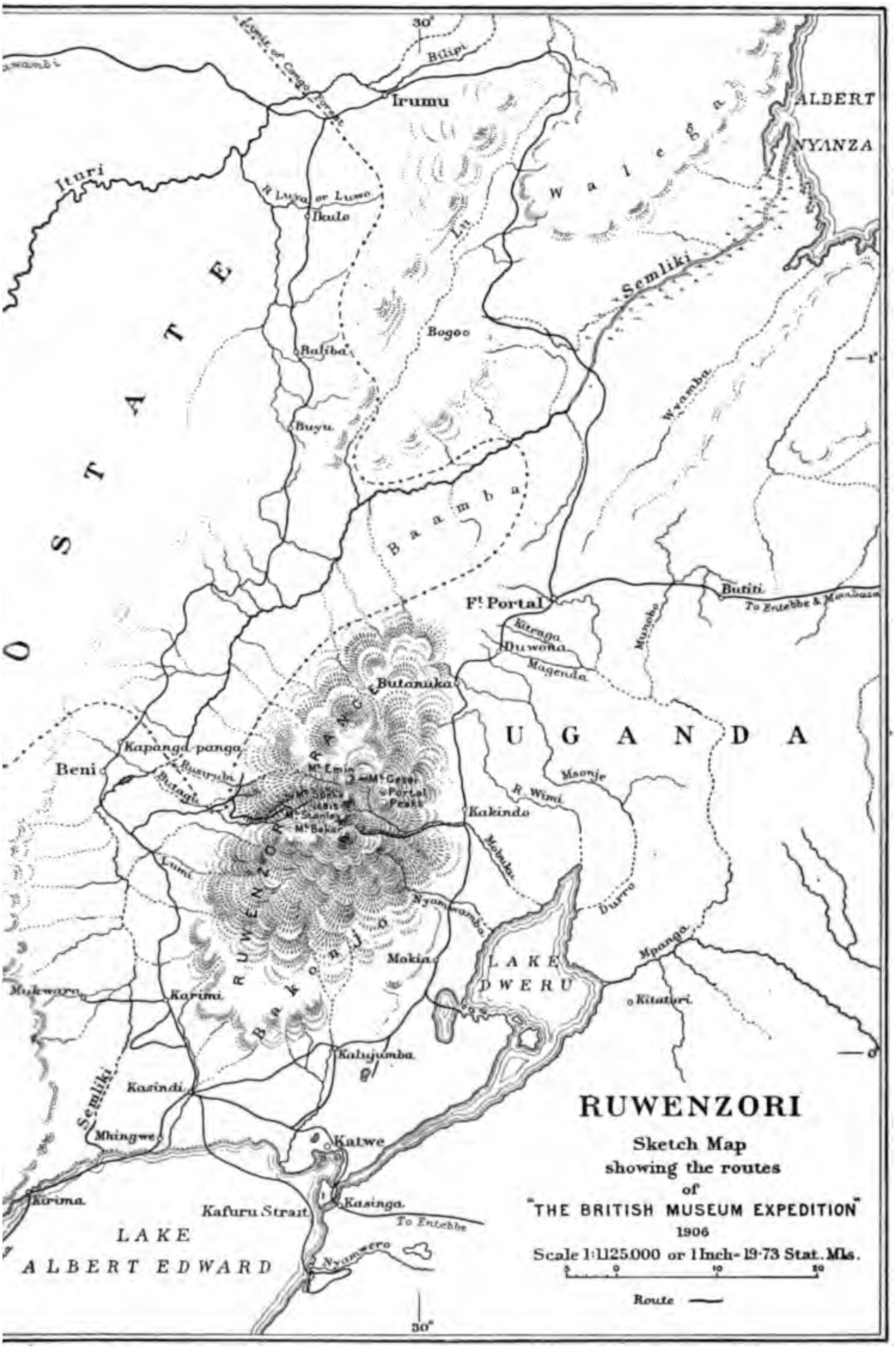
By R. B. WOOSNAM, of the British Museum Expedition to Mount Ruwenzori.

ITINERARY OF THE RUWENZORI EXPEDITION.

THE expedition left England early in October, 1905, arriving at Mombasa in November. The journey from Mombasa to Entebbe on the west coast of Lake Victoria now occupies three days, whereas before the construction of the Uganda railway it was a long and difficult march of three months. After a short delay at Entebbe to arrange the caravan, the expedition was able to set out for the march of 180 miles to the mountain range of Ruwenzori, on the western border of Uganda, the object of the expedition being to make collections of natural history specimens, and especially of birds and mammals from the little-known Mountains of the Moon. Interesting objects on Lake Victoria are the great war canoes, holding as many as forty paddlers, which are made of long thin planks hewn from the centre of long tree-trunks.

As Toro, the western province of Uganda, was approached, a sharp look-out was kept for the first glimpse of the Mountains of the Moon, but it was not until two days before reaching Fort Portal that we were rewarded with a view. At dawn, from a camp about 30 miles from the foot of the mountains, we obtained for the first and only time a view of the entire range absolutely clear of cloud. A great mass of dark blue mountains lay spread out before us in the form of a long ridge,

* Read at the Leicester Meeting of the British Association, August, 1907.



RUWENZORI
Sketch Map
showing the routes
of
"THE BRITISH MUSEUM EXPEDITION"
1906
Scale 1:1125.000 or 1 Inch = 19·73 Stat. Mls.
Route
ALBERT NYANZA
LAKE ALBERT EDWARD
LAKE DWERU
UGANDA
CONGO STATE
Irumu
Ituri
Semliki
Beni
Ft. Portal
Butiti
To Entebbe & Mombasa
Kasindi
Katwe
Kasinga
Kafuru Strait
To Entebbe
Kirima
Mhingwe
Karimi
Kalujumba
Mokia
Kakindo
Butanuka
Duwona
Kitatuiri
Bogoo
Buyu
Baliba
Ikulo
Baamba
Walega
Bakonjo
RUWENZORI RANGE
Mt. Emin
Mt. Gessi
Mt. Speke
Mt. Stanley
Mt. Baker
Portal Peaks
Kapanga-panga
30°

culminating rather south of the middle in the cluster of highest peaks of snow and patches of black rock. Towards the north the ridge ran down gradually in a long slope nearly to Lake Albert.

The first camp was formed in the Mobuku valley, on the east side of the range, at an altitude of 6500 feet, and was occupied for four months. From it short expeditions lasting for eight or ten days were made up to the higher regions and snows, and it was from this camp that the greater part of the collection was made.

The impenetrable nature of the forest and bamboos, and the almost total absence of native paths on Ruwenzori, except from village to village below 7000 feet, prohibit much exploration without considerable expense in cutting roads.

The inhabitants of the east side of Ruwenzori are Bakonjos, a peaceful, hard-working tribe, with whom we were upon most friendly terms. As a rule the lower limit of the forest belt is the limit of native habitations, but in the Wimi valley the Bakonjos have made a large clearing in the middle of the forest at 8000 feet, and have built a village, which was the highest point at which human habitations were found upon the mountains. They subsist almost entirely upon vegetable food, beans, colocasia-arums, and a small species of millet being the crops cultivated. Bananas are only grown in the lower valleys. They own small herds of goats, but seldom kill them for food, although they are fond of flesh and eat the hyrax, in pursuit of which they make expeditions as high as 12,500 feet. This is the origin of the path to the snows in the Mobuku valley. In the Wimi valley there is no path above 8000 feet, and the natives all say that it is because they do not hunt the hyrax in this valley.

From the Mobuku valley a move was made to the south end of the range, where another base camp was formed at an altitude of 3400 feet, and was occupied for two months. A dry country of short grass and acacia trees extends around the south of Ruwenzori down the Semliki as far as the Lumi river, and from that point to Fort Beni the road passes over open undulating plain, covered with spear-grass and with many tall borassus palms dotted about. From Fort Beni nearly to the north end of Ruwenzori, the Semiliki valley is overspread by the Congo forest, which extends up on to the lower slopes of the mountains. This part of the Semliki valley and Ruwenzori is almost unexplored; at the time of our visit the tribes dwelling there had rebelled against Belgian authority, and we were unable to enter it. There is no doubt that cannibalism is still practised in this district, and also by the Baambas on the north-western slopes of Ruwenzori. Between Lake Albert Edward and Fort Beni the Semliki is a shallow sluggish river, and there are no rapids in this section; below Fort Beni shortly after it enters the forest, there is a dangerous rapid, and probably there are more lower down in the forest. It is a noteworthy fact that no crocodiles were seen nor any traces of them found either in Lake Kivu or Lake Albert Edward or the upper part of the Semliki above the rapids, and the natives all insist that they do not exist there; but in Lake Albert and the lower part of the Semliki crocodiles abound, and are always to be seen, as also in Lake Tanganyika and the Congo rivers. Why there should be none in Lake Albert Edward is a mystery; the rapids on the Semliki would certainly not explain it.

From the camp at the south end another move was made round into Belgian territory, with the intention of making a third camp on the west side of the range in a position corresponding to the first camp in the Mobuku valley. A suitable camping-place was found in the Butagu valley at an altitude of a little over 7000 feet; but, unfortunately, owing to the rebellious state of two of the tribes at the foot of the mountains, it could only be occupied for three days, when matters became so unpleasant that collecting was out of the question, and the expedition was

compelled to beat a hasty retreat back to Fort Beni, the Belgian post on the Semliki river. This was a great disappointment, as no systematic collecting has been done in that district which lies on the west side of Ruwenzori, between the Butagu valley and the north end of the range. The Butagu is the largest valley on the west side,

THE GRASS ZONE BELOW 6500 FEET. DRACÆNAS IN THE FOREGROUND.

DENSELY WOODED RIDGES OF THE FOREST ZONE, WITH THE CLOUD BLOWING UP THE VALLEY.

and leads directly to the snows, but the river has not such a volume of water as the Mobuku on the east side. The south side of the Butagu valley is very steep; the north side has a more gentle slope, and a little above 6000 feet opens out into a broad valley, at the bottom of which is a deep groove. This appears as if it had

been cut by the stream after the glacier which probably occupied the valley had disappeared.

From Fort Beni a hurried march was made through the forest to Irumu by an entirely unused road on the west of the Semliki valley, no inhabited villages being seen, nor food for carriers obtainable for nearly 100 miles. This is probably one of the most uninhabited parts of the whole Congo forest, and the numbers of elephants and buffaloes which frequent it are extraordinary. During the heaviest rains, in October, November, and December, great numbers of elephants leave the forest for the more open parts of the Semliki valley. About 6 or 8 miles before reaching Irumu the forest comes to an abrupt end, and open rolling country of tall grass with patches of forest in the hollows takes its place. From Irumu a well-used road was followed back to Fort Portal. Shortly after leaving Irumu, this road passes over low hills which form the watershed of the Nile and Congo rivers, and extend along the west bank of the Semliki to the mountains on the west of Lake Albert Edward. Camps were formed for a short time in the Wimi valley and at the north end. After this the expedition set out on the return journey to England, travelling through the Congo forest to Boma on the West Coast.

At the present day this is an easy journey to make provided the sanction and assistance of the authorities of the Congo Free State have been obtained. From Fort Portal the road taken passed through Irumu, where we had been before. From Irumu, a march of eleven days through the forest, along a well-kept path, brought us to the next Belgian post, Mawambi. Here it was necessary to change carriers and engage fresh ones for the march of eight days to Avakubi, on the Aruwimi river. From this point on the Aruwimi dug-out native canoes are used for all transport, and in this manner we continued our journey down to Basoko, where the Aruwimi joins the Congo. There are many dangerous rapids on the Aruwimi, and at each it is necessary to unload the canoes, which are then taken down the rapids by expert canoemen, while the baggage is carried round to the smooth water below by the women, who do all the work of carriers in the Aruwimi district, the men only working as canoemen.

At Basoko we said good-bye to canoes and canoemen, but not without regret, and embarked in the steamboats which are now running regularly up and down the Congo. From Basoko ten days brought us to Leopoldville, at the head of the rapids, where it is necessary to disembark, the remaining journey of two days to the coast being made by railway.

General Features of Ruwenzori.

Ruwenzori is a mountain range lying just north of the equator, forming a long ridge between Lakes Albert and Albert Edward. The range is about 65 miles long by about 30 broad across the widest part, and does not run due north and south, but rather north-north-east and south-south-west. The highest part of the ridge is formed by a cluster of peaks a little south of the middle, at the point where the range is broadest, one of the peaks attaining an altitude of 16,816 feet (altitude obtained by H.R.H. the Duke of the Abruzzi). The slope of the west side of the range is very much steeper than that of the east, and the distance from the foot of the mountains to the watershed considerably less.

At the south end two long narrow spurs project from the main mass into the Albert Edward plain, almost reaching the shore of the lake. At the north end of Ruwenzori, the lower slopes gradually subside into the high country of over 5000 feet which surrounds Fort Portal, and extends along the east of Lake Albert. But the main ridge, at this point quite narrow, extends to within a few miles of Lake Albert. The glaciers and permanent snow-fields of Ruwenzori are only insignificant

remains of what they must have been during the glacial epoch, and an area of 10 miles long by 8 miles broad contains all the permanent snows at the present day. One of the most characteristic and unpleasant features of Ruwenzori is the cloud which almost perpetually envelops the upper regions of the range by day. Looking down from the mountains in the early morning, the clouds can be seen forming into a mass which gradually rises and drifts up into the range, all the while receiving reinforcements from the hot, damp atmosphere, which is invisible below during the heat of the day, and only becomes visible cloud as it reaches the cool

MOSS ON THE TRUNKS OF THE TREE HEATHS AT 11,000 FEET.

higher levels of the mountains, till by 9 a.m. all signs of snow-capped mountains are blotted out, and from below travellers see nothing but a great bank of cloud apparently resting upon a high ridge. This is the real reason why Ruwenzori remained undiscovered for so long, although several travellers approached within sight of it before its actual discovery by Sir Henry Stanley in 1888. The part of the range which is usually covered by cloud, is from about 9000 feet up to the summit on the east side (on the west the cloud descends lower), and these regions have consequently an excess of moisture which, together with the constantly warm temperature, has produced the extravagant growth of mosses and lichens which are such a remarkable feature of Ruwenzori. The rainfall, which is abnormally heavy,

must be nearly 100 inches per annum, and is to a great extent local; but the wet and dry seasons, so far as they can be said to exist, correspond fairly well to those of the Toro district, which are as follows:—

January and the first half of February is the most reliable dry season. The latter half of February, March, April, and May are rather wet months; June, July, and August are usually dry, but not invariably so; September, October, November, and December are wet, the heaviest rainfall being in November and December.

There is a very marked contrast between the climate of the south end and the central portion of the range. At the south end the rainfall is much less, the vegetation is short grass and acacia trees, the whole district having a dry, arid appearance much like parts of South Africa; the same conditions occur at the north end, but not to such a marked degree as at the south. On Kilimandjaro, the south side is the wet side. The west side of the range has even a more humid climate than the east, and it receives considerably less sunlight owing to the cloud.

Above 6000 feet the temperature never rises very high, nor does it fall very low at the summit. In the Mobuku valley, the maximum and minimum Fahr. observed during four months averaged—maximum, 74·04; minimum, 58·16. At 12,500 feet the maximum observed was 51·5, and the minimum 36·0; and above snow-line, maximum 43, and the minimum 26. Ruwenzori feeds innumerable streams, of which the most important on the east side are the Mobuku, the Wimi, and the Nyamwamba. The Mokubu is fed by the snows, and probably the Nyamwamba is also. Several small streams from the north end unite below the mountains and form the Mpanga.

On the west side the Butagu is the largest, and there are two smaller streams south of it, the Lumi and Ululu. The Butagu is fed by the snows, and there is another river, the Rusirubi, a little north of the Butagu, which is also probably a snow-fed stream.

Life-zones of Ruwenzori.

Ruwenzori is divided into fairly well-marked zones of vegetation running concentrically round the ridge in belts, which can be most clearly shown in a diagram.

These divisions must not be taken as hard-and-fast lines of difference, for the edges of the zones necessarily merge gradually one into another, and specimens of the characteristic vegetation of one zone may often be seen in another, and there is always a difference between the altitudes of the zones in valleys or on exposed ridges. Neither is it intended to imply that the particular plants named constitute the only vegetation of the zone, such species being taken merely as the most conspicuous and characteristic of certain altitudes. The boundaries of these zones are not so well defined on the west side, and extend lower down than they do on the east, which may probably be accounted for partly by the more humid climate of the west side and Congo basin, and partly by the cloud-bank which accumulates before the sun has reached a position to shine upon the western slopes, thus sheltering them from its rays.

Grass Zone.—Commencing at the foot of the range and working upwards, there is first the grass belt, which is merely a continuation of the surrounding country of the plains, and extends up on to the lower slopes of the range to an altitude of 6500 feet on the east, and somewhat lower on the west, and includes most of the species of flora and fauna characteristic of the surrounding districts.

Forest Zone.—Above the grass the forest appears at 6500 feet, and extends upward to an altitude of 8500 feet. On a clear day when the cloud rests upon the higher part of the ridge, leaving the country below 10,000 feet exposed, an

instructive view can be obtained from Fort Portal. The forest belt appears as a well-defined dark band running the whole length of the ridge without a break, but diminishing in breadth towards the north end, until at the point where it turns over the ridge it is only a narrow strip about 100 yards wide, and a good deal mixed with the bamboo. On the west side the Congo forest joins with the Ruwenzori forest zone in the form of a broad tongue protruding across the north central part of the Semliki valley and extending right up on to the western slopes until it meets the forest zone. In many places the forest has been cut back several hundred feet by the natives clearing the ground for cultivation, and the large open spaces covered with fern which are to be seen among the forest are also old sites of native cultivations. From some of these clearings a view can be obtained over densely forested ridges rolling away on all sides until shut out by clouds above. The lower margin of the forest zone, especially in the valleys, is almost as tropical

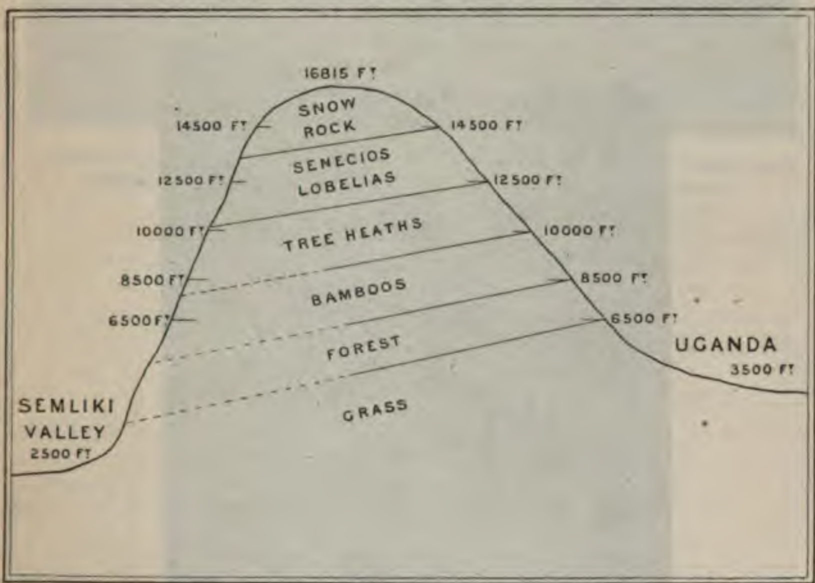


DIAGRAM OF THE RUWENZORI RANGE (VIEWED FROM THE SOUTH), SHOWING THE SEQUENCE OF ZONES OF VEGETATION, AND THE WAY IN WHICH THE LIMITS OF THE ZONES ARE LOWER UPON THE WEST.

in appearance as the forests of Uganda and the Congo, and here many species occurring in the Uganda and Congo forests are found also; but at 7000 feet much of the tropical nature of the vegetation disappears, and species of birds and mammals known only from Ruwenzori begin to appear. In this zone at 7000 feet appears the first of the lobelias, which form such a conspicuous feature of the higher regions; this species (*Lobelia giberroa*) ranges from 7000 to 8500 feet on Ruwenzori, and is found also on the mountains of Abyssinia. A fine species of conifer (*Podocarpus milanjiana*) appears at 8000 feet, in the upper region of the forest, and continues on the crests of ridges in isolated clumps throughout the bamboo zone to 9500 feet. Perhaps the largest tree is found in the lower valleys (*Pseudocedrela utilis*), which attains a great size, and is said to be a valuable timber tree. Up to this altitude in the grass and forest zones, life is abundant;

there is a large variety of small mammals, and on a bright morning the forest is teeming with bird-life, but above the forest there is a marked contrast, and as the higher regions are reached signs of life become still less.

Bamboo Zone.—The bamboo zone, which comes next above the forest, may be taken as extending on the east side from 8500 feet to 10,000 feet, and on the west from 7000 feet to 8500 feet.

Where it is unmixed with forest it is impenetrable without cutting a path, for the older bamboos, having fallen, are lying across between the stems of the others, and make a most effectual barricade. In these dense jungles of bamboo there is

TREE HEATHS AT 12,000 FEET. MOUNT BAKER IN THE BACKGROUND.

little or no life, the birds preferring the more open parts, and the mammals, with the exception of monkeys and chimpanzees, finding no food to attract them thither. These latter frequent the bamboo zone in search of the young shoots, and traces of chimpanzees were found as high as 10,000 feet.

Tree-heath Zone.—At 10,000 feet the tree-heaths (*Erica arborea*) are abundant, and extend in a dense forest up to 12,500 feet, and although they appear a little below 10,000 feet, and continue a little above 12,500 in isolated clumps, the typical zone of tree-heaths may be taken as extending from 10,000 to 12,500 feet. This zone forms a broader belt than the others, especially upon the west side, where it

VEGETATION AT 12,000 FEET. TREE HEATHS, LOBELIAS, AND GIANT GROUNDSELS (SENECIO) STANDING AMONG EVERLASTING FLOWERS (HELICHRYSUM).

LOBELIA DECKENII AT 12,000 FEET.

extends more than 1000 feet lower than on the east, and there is a great contrast in the size of the individual trees of heath, which are not more than 10 or 15 feet high on the west side at 10,000 feet, while they attain 40 feet or more on the east side at the same altitude. Possibly they are of a different species.

It is difficult to give any idea of the weird and extraordinary scenery of this part of Ruwenzori. The trunks and branches of the trees are wrapped up in thick coats of moss, huge swollen masses of it in all manner of grotesque shapes hanging from every stem. The trees are leaning at all angles as if weighed down by their burdens of wet moss. Generations of dead ancestors are lying across each other upon the ground, covered over with a treacherous layer of soft moss a foot or more deep, making the walking difficult and dangerous, for these fallen trees are not soft rotten wood, but well preserved and hard as steel. At this altitude the bottoms of the valleys are frequently flat peaty bogs, destitute of tree-heaths, and here may be seen one of the most conspicuous of the lobelias (*L. Deckenii*), a species which occurs also on Kilimandjaro. This particular species seems confined to these flat bogs, and was never seen among the other lobelias on the sloping hillsides. Another species of lobelia found in this zone is *Lobelia Stuhlmanni*, which ascends to about 12,000 feet, where it is replaced by a somewhat similar species (*Lobelia Wollastoni*), which is the dominant species above the tree heaths, and flourishes up to 14,000 feet.

In this zone, at 10,000 feet alpine forms begin to appear, the pretty silvery leaves of the alchemillas often thickly covering the swampy ground. The giant groundsels also begin at about 10,500 feet, but are most plentiful above 12,500. This species (*Senecio adnivalis*) is found only on Ruwenzori, but is closely allied to *Senecio Johnstoni* from Kilimandjaro, and another nearly allied form is found on Mount Kenia. Very few birds inhabit these wet and gloomy regions, and the total number recorded as seen in the tree-heath zone only amounts to fourteen species, one of which, a beautiful sun-bird (*Cinnyris Stuhlmanni*), is remarkable in being absolutely confined to a belt of a little more than 1000 feet, occupying the upper margin of the bamboo and the lower half of the tree-heath zone.

Lobelia and Groundsel Zone.—At 12,500 feet the tree heaths cease, and from this altitude almost up to snow-line the stately lobelias and fantastic senecios form the characteristic vegetation. Everlasting flower bushes, which are conspicuous a little above 11,000 feet, also grow in profusion, and continue above the senecios, which disappear at about 14,000 feet. The ground here is soft black mud, covered over with deep moss of many shades of green and yellow. The lobelia which forms such a feature of this zone is a species new to science (*Lobelia Wollastoni*), known only from Ruwenzori, but is closely allied to a species (*Lobelia rhynchopetalum*) from the mountains of Abyssinia at 11,000 to 13,000 feet. *Lobelia Deckenii* is also to be seen as high as 13,000 feet, growing on the more level ground in the valleys.

Another remarkable sun-bird of a dark metallic green (*Nectarinia dartmouthi*) inhabits this zone, and is absolutely confined to it, never being seen below 12,500 feet among the tree heaths, but seeking its food only among the blue flowers of the lobelias.

Snow Zone.

Permanent snow lies at about 14,500 feet, and as Ruwenzori is practically on the equator, the snow-line is constantly at the same altitude, so that there are no birds or mammals which show any seasonal change of colour on account of the snow, nor are there any Palæarctic forms, although among the flora there are many alpine genera. No birds or mammals live above the snow-line. Butterflies, moths, and diptera were seen on the snow up to 16,000 feet, but they were only accidental

stragglers from below, and not residents. On the bare rocks above the snow a few lichens and mosses were seen.

It was most unfortunate and disappointing that the expedition was prevented from making systematic collections on the west side, for there is so little material from the west that a comparison of the two sides is hardly possible at present. Of the birds, although only a few were obtained on the west side, we saw and heard sufficient to enable us to say that all or nearly all the species which inhabit the east side above the grass zone—that is, above 6500 feet—are found also on

LOBELIAS AND SENECHIOS AT 13,000 FEET.

the west. Many small mammals known from the east side were also identified on the west, and it will probably be found, when sufficient material has been obtained, that the fauna above 6500 feet is identical on the east and west sides of the range.

This is true also of the flora in general, but from the hurried observations we were able to make, we were inclined to the opinion that there are numerous plants upon the west side which are not found on the east.

A detailed account of the distribution of the fauna on the range, in many instances confined absolutely to certain zones, would take too long to give, but a short outline of the birds and mammals may be of interest.

The larger mammals, such as elephants, buffaloes, water-buck (*Cobus defassa*), kob (*Cobus thomasi*), reedbuck (*Cervicapra arundinum*), and bushbuck (*Tragelaphus*

scriptus), which inhabit the plains and low foothills, do not ascend the mountains above 5500 feet except the bushbuck, which occasionally follows up the valleys into the forest as high as 7000 feet. Pigs are plentiful up to the limit of the forest, but do not go higher than that. In this part of Uganda the lions prey almost exclusively on the wild pigs, following them up the mountains, and on this account lions may very occasionally be seen up to 7500 feet. Leopards are found as high as the snow-line, but they are only occasional visitors above 10,000 feet, and are really inhabitants of the grass belt and lower forest region; two small red duikers (*Cephalophus johnstoni* and *C. rubidus*) are known from Ruwenzori, and range up to 10,000 or 11,000 feet.

Two species of monkeys inhabit the forest zone (*Cercopithecus stuhlmanni* and *Colobus ruwenzorii*), and baboons are not uncommon among the dry grassy hills at the south end below 7000 feet, while chimpanzees may often be heard in the forest, and are found up to 10,000 feet. The forest and lower slopes support a large variety of smaller mammals, a few of which, such as *Mus denniæ* and *Lophuromys aquilus*, continue almost to snow-line. A single species of hyrax occurs on Ruwenzori, and is found from 10,000 feet up to 14,000 feet, but is most plentiful in the tree-heath zone. A large serval cat inhabits the same regions as the hyrax, upon which it preys, but with the exception of these, the resident mammals above 10,000 feet are only very small rodents or insectivorous animals. There is also one species of fruit-eating bat known only from Ruwenzori, which occurs from 11,000 to 13,000 feet, and is the only bat found above 10,000 feet.

Of the resident birds of Ruwenzori, the majority are of small size—kites, buzzards, and ravens being the largest found upon the mountain. In the grass zone and lower slopes, *Cisticolas* and small finches, such as *Cryptospiza*, *Estrelda*, and *Pyromelana*, are largely represented; but in the forest zone these disappear, and many species of flycatchers and small warblers take their place. Sun-birds, both *Nectarinia* and *Cinnyris*, are numerous in the forest and below. One of these (*C. regia*) is known only from Ruwenzori, and is confined to the forest and bamboo zones. Another (*C. stuhlmanni*) is found only from 10,000 to 11,000 feet, and a third (*Nectarinia dartmouthi*) inhabits only the zone of lobelias and senecios above 12,500 feet. This latter is peculiar to Ruwenzori, but is nearly related to a species (*N. salvadorii*) from Nyasaland. Two species of turacos are found on Ruwenzori, one (*Turacus emini*) being plentiful in the Congo forest and on Ruwenzori up to 8000 feet, where it is replaced by another somewhat similar species (*Gallirex johnstoni*), which continues up to 11,000 feet. *Francolins* are found up to 8500 feet, but are not plentiful. Near the summit of the range, frequenting the steep cliffs near the snow, is found the largest swift in the world (*Cypselus maximus*), which lives at a greater altitude than any other bird on Ruwenzori, and is peculiar to it. A few birds were discovered on Ruwenzori, which were previously known only from the Cameroon mountains of West Africa. Among these there is one remarkable bird, a large yellow shrike (*Laniarius lagdeni*), of which only one specimen was known to exist in collections. A pair of these birds were seen on Ruwenzori, and one was obtained, and this is the only other specimen which has ever been obtained.

I should like to be able to say that we had found birds or mammals with special adaptations to the wet and cold of Ruwenzori, but nothing very remarkable in this way was noticed; on the contrary, the most numerous species inhabiting the wettest and coldest zone from 12,500 to 14,000 feet is a sun-bird of brilliant colour.

A species of sun-bird (*Cinnyris reichenowii*) which is found in East Africa is found on Ruwenzori up to 7000 feet. It then disappears, but at 10,000 feet another species appears which is its exact facsimile in every detail, but is twice the size of it.

There is a similar case among the plants, a lily (*Gloriosa virescens*) growing in the lower valleys of Ruwenzori which reappears as a very large-flowered form at the higher altitudes.

This increase in size is probably the result of cooler climate at higher altitudes, it being a well-known fact that the representatives of species inhabiting more northern latitudes are often larger than those found further south. For instance,

THE MUBUKU VALLEY BELOW THE GLACIER. GIANT GROUNDSELS IN THE FOREGROUND.

in the Himalaya we find a large race of the pied hornbill (*Anthracoceros affinis*), while in Burma its place is taken by *A. malabaricus*, a form distinguished only by its smaller size.

Some plants show slight modifications on account of the cooler climate at high altitudes. The lobelia at 7000 feet has large broad soft leaves, in contrast to the three species above 10,000 feet, whose leaves are long, narrow, and leathery, and the leaves of the everlasting flowers above 11,000 feet are more hairy than those of a species (*Helichrysum stuhlmanni*) from 6000 feet. Probably this is a provision of nature enabling them to withstand the cooler climate.

AN EXPLORATION OF THE MUSTAGH PASS IN THE KARAKORAM HIMALAYAS.

By AUG. C. F. FERBER, F.R.G.S.

A long-cherished design of visiting the icy regions of Central Asia was greatly strengthened in me through reading Colonel Younghusband's most interesting book, 'The Heart of a Continent.' His climbing experiences on the Mustagh pass seemed to me especially alluring, and thinking that perhaps some sort of history might be connected with that pass, I made up my mind to visit it.

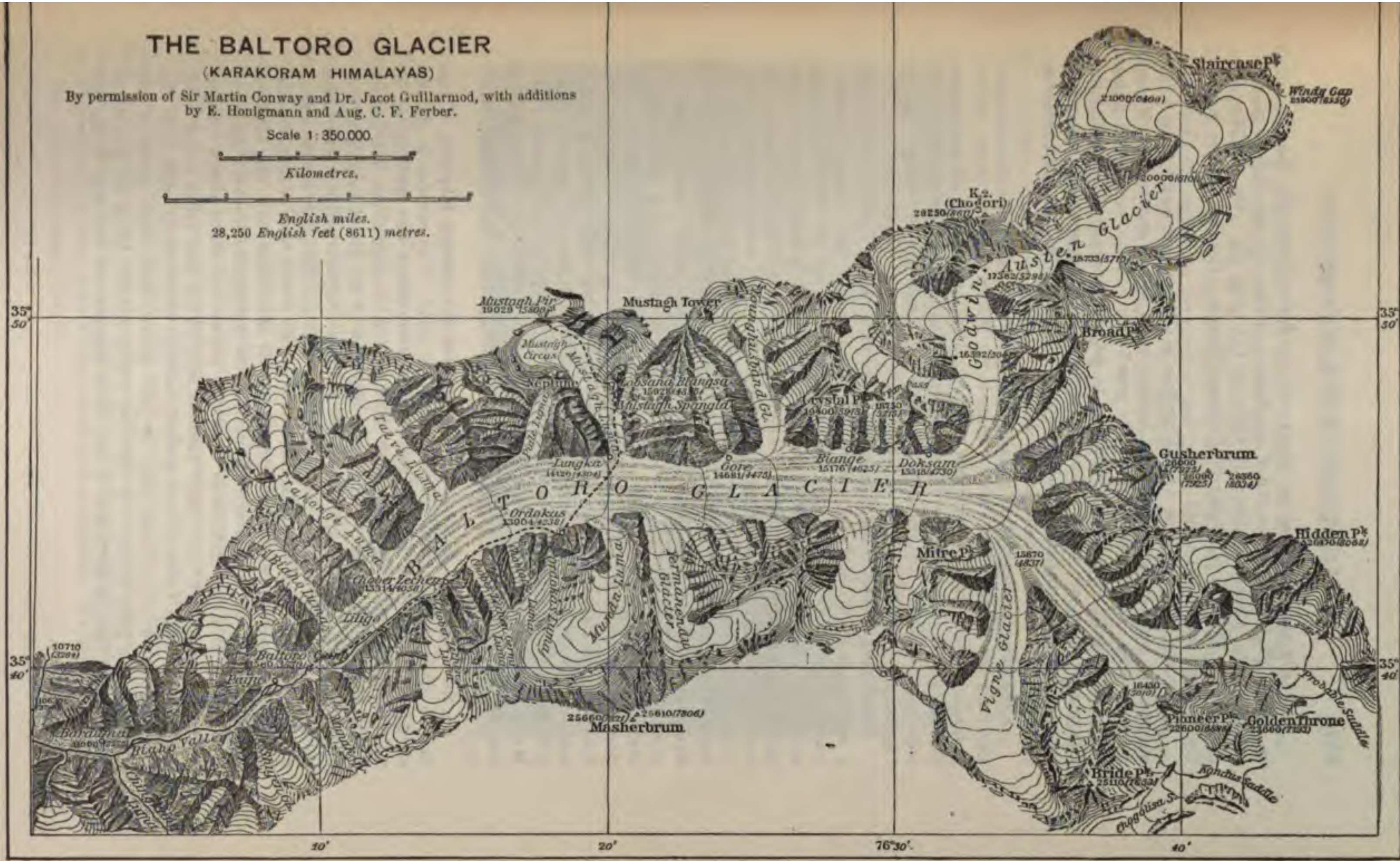
As to the general situation, let me mention that besides the Karakoram pass to the east and the Gilgit pass to the west of the huge Karakoram ridge, there is the Mustagh pass situated nearly in its centre, and offering a connecting link between Kashmir and East Turkestan. Representing the shortest route from Skardu in Baltistan to Yarkand, it lies to the north of the long Baltoro glacier, and very near Mount Godwin Austen, or K_2, or Chogo Ri (28,250 feet). For fifty years, more or less, it has been blocked by the advancing ice, however, so that the natives have abandoned it.

Before our attempt was made, this pass had only been crossed once by a European. This was Colonel Younghusband, who in 1887 came from Peking across the Gobi desert to Yarkand. Leaving this place, he tried the Mustagh pass, and finding that he could not cross it with his mules, he left them behind, and went on himself with a handful of courageous men, made a dangerous descent, and safely reached Askole, the nearest village in Baltistan. In 1892 Sir Martin Conway undertook an expedition up the Baltoro glacier, and mapped it. His book, 'Climbing in the Himalayas,' proved to be very useful to us. The oldest description of this part of the Himalayas was contributed to the pages of the *Journal* of the R.G.S. by Colonel Godwin Austen, in the year 1864. A recent publication on the subject is Dr. Jacot Guillarmod's work, 'Six Mois dans l'Himalaya,' an account of Mr. Eckenstein's expedition in 1902.

On September 8, 1903, my friend Herr E. Honigmann and I set out from Srinagar, the picturesque and dirty capital of Kashmir, with suitable equipment and attendants. It is unnecessary to give the details of our journey over the fairly well-known country between Srinagar and Little Tibet.

On the evening of the 16th we rode into Skardu, the capital of Baltistan; and on the morning of the 23rd we entered Askole, and in a shady garden the tiresome bargaining with the natives began. The whole village was aroused. Men, some with a semitical type of face, old women, and children besieged the low garden wall and took the keenest interest in the struggle. Happily we had sent to the place the day before to explain our intentions, otherwise they might have made themselves quite ill with excitement. We waited patiently until everybody had given his opinion, and then, when all were quieting down, began to make our arrangements.

Three people were of importance to us: the Lombardar or Mayor of Askole; Kitul from Teste, who explained that he had succoured the men whom Colonel Younghusband had to leave behind on the other side of the Mustagh pass, and therefore ought to be the guide; and Salman from Teste, who, having been a servant in Simla, and understanding Hindustani, was extremely valuable to us, as no one of the Kashmiri understood the Balti. He was the dandy of the place, wore boots, and had blue buttons on his shirt. The Lombardar showed us a few recommendations from travellers, among which I found one from Sir Martin Conway.



THE BALTORO GLACIER
(KARAKORAM HIMALAYAS)
By permission of Sir Martin Conway and Dr. Jacot Guillarmod, with additions by E. Honigmann and Aug. C. F. Ferber.
Scale 1: 350.000.
Kilometres.
English miles.
28,250 English feet (8611) metres.
Staircase Pk
Windy Gap
K2 (Chogori)
Godwin Austen Glacier
Broad Pk
Mustagh Pir
Mustagh Tower
Mustagh Circus
Younghusband Gl.
Crystal Pk
Gusherbrum
Hidden Pk
Lungka
Gore
Biange
Doksam
Ordokas
BALTORO GLACIER
Mitre Pk
Vigne Glacier
Yermanendu Glacier
Masherbrum
Pioneer Pk
Golden Throne
Probable Saddle
Bride Pk
Kondus Saddle
Trakonge Luma
Liligo
Baltoro
Biaho Valley
35° 50'
35° 40'
10'
20'
76°30'
40'

The daily stages we fixed as follows:—In the Biaho Valley: (1) Korofon; (2) Bardumal; (3) Paju, near the end of the Baltoro glacier. On the Baltoro glacier: (4) Liligo; (5) Chober Zechen; (6) Ordokas; (7) Lung Ka. On the Mustagh glacier: (8) Mustagh Spangla; (9) Lobsana Blangsa. On the Chinese side of the Mustagh pass: (10) Chang Tok.

Each coolie, of whom there were thirty-four in all, was to receive 4 annas a day and one seer, equal to 2 lbs. of flour, and nothing more. But we promised that if they did their work well, we would give them presents in addition—a proposal which proved most useful. At last we were able to get away, passing at the end of the village two old square watch towers, fortresses in olden times against marauders, but now peaceful granaries. A beautiful species of broom with terra-cotta blossoms, and a pale blue thistle, afforded a bouquet ready to hand.

In the following description I shall use such names as the Balti gave me, and after them add in brackets the word I found in Sir Martin Conway's chart. A line in brackets means that no name was to be found in the chart. I do not assume that the names I give are the only correct ones, but took the precaution only to note those on which the Balti were unanimous. Luma means "valley," paro = "fireplace."

We crossed the foot of the Bio glacier (Biafo) and reached Korofon, from where a track leads up to the Laskam pass. A most beautiful view repays the slight trouble of mounting to it. Facing the valley to the left are the towers and peaks around the Punmah glacier, where possibly a way might be found to the so-called new Mustagh pass, of the existence of which, however, the natives always assured me they knew nothing. Then follows the upper Biaho valley, and in continuation of it the Ching Kang Luma (—), beginning opposite Bardumal, and closed in the far distance by an enormous snow-mountain. Right opposite on the left bank of the Braldu river stands a huge glacier-clad tooth, and from down the valley below the moraine-covered end of the Bio glacier, Teste's green gardens and fields send up their greetings. The second day we reached Bardumal, and on the evening of the third we camped near Paju (—), at the end of the Baltoro glacier. In the river sand we found gold, and I heard that an attempt had been made to wash it, which, however, did not pay. The sun was intensely hot. At noon we registered about 102° Fahr., and its rays were powerful enough to melt a spot of candle-grease which Mahud, our servant, had neglected to remove from my sleeve. One may imagine that a march in that stony valley, up and down hill, and with no shade, was not an ideal form of exercise.

On the morning of September 26 we entered the moraine labyrinth of the Baltoro glacier, the length of which is about 30 miles. The moraine is old and blackened by time and weather, and in some parts plants were growing on it. Walking up and down high and small moraine hills, we wended our way towards the left bank of the glacier. Lumps of frozen snow of the size of a man's head or even larger were lying about, and we could not make out their origin. After three hours' walk we reached Liligo (—), the 4th paro. This is a flat place, semicircular in form, covered with rounded stones, and shut in on one side by walls of conglomerate. We now followed the left bank of the glacier as far as Ordokas (—). Big blocks of ice, breaking off the glacier and falling into the watercourse we were following, made us cautious. In addition to these, the glacier sent down stones from its high muddy edge. In three hours' more we came to the first valley to the right, the Chober Zechen Luma (Liligua glacier), having a glacier at its upper part. Its grey waters flow into a small *märjelen lake* covered with large blocks of ice, children of the giant Baltoro. We stood on a high moraine hill at the west corner of the valley, right in the axis of a long valley opposite, the Trahongé Luma (Uli

Biaho glacier). On the other side of the Baltoro the mountains facing south are scorched by the burning sun. But little snow can be seen lying on their huge masses of solid rock. As far as the Mustagh Luma (Piale glacier) all these rocks look a light yellowish-brown, but higher up the glacier, dark blueish-black. The Balti called the valleys to the north of the Baltoro and beginning at its end as follows: (1) Uli Biaho Luma (—); (2) Trahongé Luma (Uli Biaho glacier); (3) Talve Luma (Dunge glacier); (4) Piale Luma (Durni glacier); (5) Mustagh Luma (Piale glacier).

After having rounded the lake, we encountered a *mauvais pas*, and after an hour's walk reached Chober Zechen (—), the 5th paro. By now, without counting rest, we had been seven hours coming from Baltoro camp, but I should add that we stirred up the coolies to exertion.

The next morning at seven o'clock the thermometer inside our tent was at 25

CURIOUS ICE-FORMATIONS FOUND ON THE BALTORO GLACIER.

Fahr. The peaks of the mountains were gilded by the rising sun, and a fresh easterly breeze awakened us to another day's work. After drinking our usual cup of cocoa, we quickly took down and packed the tents and continued our way. We had still to follow for a little while the watercourse on the left bank of the glacier, and then to climb the granite moraine, quite fresh and light in appearance, which covers the glacier of the second side valley, to our right, the Chober Zechen Germi Luma (—). By 8 o'clock we had crossed the first half of the moraine, and stood right in the axis of the opposite valley, the Talve Luma (Dunge glacier). For the first time we were aware of the majestic cone of Gusherbrum (26,360 feet), which dominates the upper part of the Baltoro. After another hour we crossed the glacier of the third side valley, the Cho Blak Luma (—), the junction of which with the Baltoro is to be clearly distinguished, for both moraines, the one light, the other dark, flow side by side down the valley. We now again betook ourselves to the hillside, which at this point was lying a little away from the glacier, forming, with the high edge of the same, a small valley filled with avalanches. We had to cross a

fresh ice-avalanche that some glacier high up in the mountain had recently sent down, and then climbed over grass up to Ordokas (—), the 6th paro, a beautiful spot nearly opposite the Piale Luma (Durni glacier).

Remnants of baskets, covered with moss, tins, etc., told us that this was the place where Mr. Eckenstein's expedition had encamped. We sent our coolies out to get some wood, as Kitul told us that higher up there was none to be had. We had now for the second time to cross the breadth of the Baltoro glacier. The more we advanced the more we enjoyed this most striking view of the snow-covered mountains which line the south bank of the glacier. On the upper part we recognized Mitre peak, then follow a good many unnamed peaks, but right in front stands the light coloured Masherbrum (25,660 feet), showing an imposing structure of rock veined like marble—truly a beautiful mountain. Looking through the mouth of the Mundu glacier, we could see it in all its lofty grandeur, its winding arêtes leading up in the wildest curves to its majestic height. Lower down the Baltoro, peak follows peak, all waiting to be conquered. The moraine hills, sometimes of considerable height, made it difficult for us to plan out a track. At the middle of the Baltoro we had to cross two small valleys with rushing streams. Three distinctly different moraines cover its surface. On the left bank it carries big granite blocks and glimmer, the middle has smaller pieces of slate, and towards the right bank every mixture of different-coloured stones may be found, amongst others, serpentine and various kinds of marble. We were struck by the extraordinary appearance of some ice-pyramids, which stood out in striking contrast with the moraine, and the origin of which we tried in vain to discover. After three hours' walking—the coolies this time taking twice as long—we reached the 7th paro, Lung Ka (camp 14,120), a deep and sandy hole at the west corner of the Mustagh Luma (Piale glacier), which looked too unattractive to camp in.

Now at last we were at the entrance of the longed-for Mustagh valley. The charm of the expedition was now to begin, as we put our foot on territory that had been visited by a European only once before, and then was not fully explored. At length we climbed the south corner of a grassy slope, surrounded by ice, the Mustagh Spangla, from whence we could study the whole valley. Deducting the rests, it took us 6½ hours to get there from Chober Zechen.

The Mustagh glacier fills the somewhat long and winding valley, is slightly undulating, and has but little fall. It carries two moraines, which cover only a very small part of the ice, in distinction to the Baltoro glacier which was entirely covered with stones, and, seen from there, presents the appearance of a broad expanse on which the contents of numerous mud-carts had been emptied side by side. Near its left bank the Mustagh glacier has a narrow strip of seracs.

On the right bank stands a line of roof-like peaks all similar one to another. It is curious to watch the difference in their appearance as you look up or down the valley. Looking up, only rocks with very little snow are to be seen; looking down, you see their north side covered with ice and snow. The upper part of this line of peaks finishes in a gigantic rock-mountain of three peaks, which suggested to us the name of Neptune. This mountain terminates the lower neighbouring valley, the Piale Luma (Durni glacier). No glacier is to be found on the west side of the Mustagh Luma, the huge Neptune only is covered with ice on its north side, concealed from our view.

The left bank is longer, less precipitous, and flanked by higher mountains. Four large and rugged glaciers, of which the last one is the Mustagh pass, are tributary to the valley. One part of the bank consists of a grassy slope covered with stones, not precipitous, and affording food to numerous ibex. As mentioned before, we were standing at the south corner of this slope.

The next morning, walking up the slope, we found, to our surprise, twenty-two huts. These were deserted and in ruins, undoubtedly a sign that this pass had been used in former times. In one of them Kitul showed us a grave marked by an upright stone. We were glad to take a few spars for burning, which were all that were left of the roofs. A little higher up we met with a second surprise in the shape of a level spot called Chagaran (—), about 800 feet long and 150 feet wide, which the natives told me was in former times used for polo, played on foot by people of Yarkand and Baltistan, who used to meet here.

SKETCH OF THE MUSTAGH VALLEY. SAME SCALE AS SIR MARTIN CONWAY'S.
1 INCH = 2 MILES.

After $1\frac{1}{2}$ hour's easy walk we reached the end of the slope at a lovely spot called Lobsana Blangsa (—), where a hermit used to live, after whom the place is called. A little brook of beautifully clear water and a carpet of succulent grass suggested the very place to camp. The distance from Baltoro camp, or Paju, is about fifteen hours' march, not counting the rests, only much depends on the coolies, who will easily take double the time.

We were now at the same height as Mont Blanc, and only 1250 feet above the

end of the Mustagh valley. Towards the south the scenery is framed like an enormous stage. Below one sees the junction of the Mundu and Mustagh glaciers with the broad Baltoro, and a splendid background is formed by Masherbrum and its neighbours. Looking up the valley, a moraine of considerable height, belonging to the second side glacier, bars the view, so that only the summits of a few peaks can be seen, one of them having the form of a round cap and lying to the west of the Mustagh pass. At the foot of this moraine we saw a few stones arranged in a semicircle and blackened by fire, which made us believe that the place had been visited not so long ago. We found edelweiss, primroses, rhubarb, and a beautiful yellow moss, which adhered firmly to the stones and occurred here and there in round patches.

The Balti seemed to me a hardy race. At night the thermometer fell considerably below the freezing-point. The people lay down to sleep in two lines close together, with their faces to the ground, those of one line putting their feet against those of the other. They had taken off their coats and used them as rugs, wrapping themselves up in them. Short wide trousers, a thin coat, a woollen belt, turban, and putties were all they had on. On the glacier they used mocassins; on the rocks, however, which they preferred much to walk upon, they went barefoot, and many of them were greatly troubled with chapped heels. They sometimes suffered from headache, which we cured by wrapping up their heads and keeping them warm. Nearly all of them had splendid teeth and sound and healthy gums. Beards were the rule. The moustache they wore cut short over the lip, as well as the hair on the middle of the head, but long black curls fell over their ears. It was amusing to observe their simplicity of mind. Having sun and meal enough, they were happy and content. They were friendly disposed, but somewhat slow, and only quickened their movements when a bakshish was in sight. If they asked for one, a thing that often happened, they put both hands together, as though praying, and bent their heads. When receiving the money, they still kept their hands joined, but opened them cupwise, wherein the daily wage of four annas, a silver coin of about the size of a threepenny-piece, looked microscopic. They all ate "roti," a coarse loaf, thin and round, about the size of a dinner-plate, which they baked every morning in ashes with the greatest care, smacking their lips the while. Their drink was tea, which they called "cha." The bread seemed to us most indigestible, but later on we were often obliged to use it, though not to our advantage. Words often failed me to describe the manifold beauties which this country affords. In the evening the sky was of a dark steel-blue, and the snow-covered giants reflected its cold light. The stars twinkled more brightly and persistently than in our hardest winter night. Far down on the horizon the new moon stood out on a background of red sky. It was as though a great fire were burning there. The Balti were sitting near the fire, talking quietly. Now and then the noise of falling stones filled the air with warning voice, otherwise deep silence reigned. The words of Schiller were brought home to me—

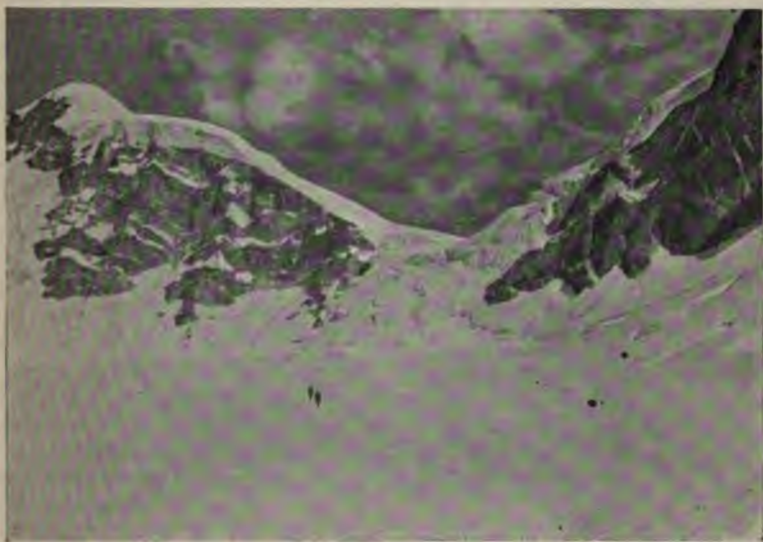
"Es gibt im Menschenleben Augenblicke
Wo er dem Weltgeist näher ist als sonst."

But poetic reveries often have their disadvantages, for whilst I was dreaming a hungry field-mouse nearly demolished my slippers. In order to keep warm at night we had to use everything we could. The unpleasant draught which pierced our beds from below we checked with American cloth. In addition, we had a couple of rugs and a sleeping-bag of sheepskin. We kept on all our underclothes and also our caps, which we turned over our ears, and only after a glass of grog did we get warm.

The morning of September 29 arrived with all its possibilities before us. We

set out a party of twelve. Only three remained at Lobsana Blangsa, and the rest were sent to Baltoro camp to procure food. We took provisions for several days, as we intended to go as far as Chang Tok on the Chinese side, where, as Kitul said, wood was to be had. From there we intended to rearrange our plans. We were accompanied by the cook, Ahamdu, carrying, as a special favour, his pots and pans himself; Mahud bringing the camera, etc., and Abdullah Lu, the tiffin coolie. There were also a coolie carrying a small tent, two more with our bedding, one with wood, one with flour, one with tinned meats, etc., and the guide, Kitul, with 53 yards of rope.

At 7.15 a.m. we started crossing the seracs of the Mustagh glacier in steps we had cut the day before, and then proceeding on the moraine on the flat part of the glacier. After half an hour's walk we were opposite the second large side glacier that from its curved form we called Snake glacier, and which forms part of a large



THE MUSTAGH PASS. TO THE LEFT, SNOW CAP; TO THE RIGHT, THE FOOT OF SEVEN PAGODAS.

mer de glace that lies here bedded between high peaks. As a matter of convenience, we gave names to the different peaks, glaciers, etc. The Snake glacier takes its origin at the north-west side of a rocky tooth, the Black Tooth, where the glacier of the same name begins, the seracs of which we had been crossing just before reaching Mustagh Spangla. Halfway down the Snake glacier is joined by another competitor, which descends from Snowy peak right above Lobsana Blangsa. Walking on, the first moraine branches off towards the Snake glacier. Then follows a group of smaller towers, sending down a steep but not extensive glacier with moraines on each side. At 8.30 we reached the third glacier to our right, the Tower glacier, a deep curved valley filled with seracs and enclosed by steep rocks, with the Mustagh tower in the background. Its great height and the dark masses of its rock, which are lighter in colour near the summit, compelled our admiration. The overhanging snow on its north-west arête made us think that the side hidden from our view might be a glacier-covered roof similar to those of the other

mountains. The Tower glacier brings down the second moraine. The Mustagh valley now takes a sharp turn to the west. We rounded the foot of Neptune, the north side of which, with its covering of ice and snow, impressed us more and more. To the right of the curve is a group of rocky towers, the Seven Pagodas, which are connected by a snow saddle with a round snow-covered summit—the Snow Cap. This saddle is the Mustagh Pir (= pass), from which comes down the Mustagh Pir glacier, steep and full of crevasses. The valley at this point forms a circus, shut in by snowfields and glaciers of medium height, which are only diversified by a few smaller peaks. To the left of them, on the south-west, stands Neptune, and to the east Snow Cap, with the Mustagh Pir as the lowest saddle. We now found ourselves on fresh snow, making it necessary for us to be on the alert against hidden crevasses. In spite of this a Balti fell into one up to his hips, and remained there like a child that falls down and cries till some one comes and helps it up. At 9.30 we reached the foot of the Mustagh pass, about 2350 feet above Lobsana Blangsa.

DIAGRAM SHOWING OUR ASCENT OF THE MUSTAGH PASS. TO THE RIGHT IS THE ROUTE CHOSEN BY HERR HONIGMANN.

The Pir glacier was impossible to climb, as it was full of crevasses. The right side near Seven Pagodas looked impossible too, and so our only hope left was the rocky wall supporting the Snow Cap west of the Pir glacier. Examining it through the glass, we remarked a narrow gallery beginning at the highest point of the old avalanche snow, and apparently leading up in an oblique direction towards the point where the Snow Cap arête joins the Pir glacier. The question was how to reach that gallery without exposing ourselves to falling stones on the avalanche side, or ice-blocks from the Pir glacier on the other. A few small balconies standing out of the lower part of the wall seemed to us the right place at which to begin. At first we climbed a short piece of avalanche snow, then reached the first balcony. From there we passed the ridge of a small roof-like snowfield, climbed the second balcony, crossed a second patch of snow about 50 feet long, and now reached the wall proper. An old wooden contrivance which we found here, such as coolies use for carrying loads, made me believe that this was the place where Colonel Younghusband descended. The trouble now was to reach the gallery, which was only

15 yards above us. We made every effort, but all our experience of the Dolomites proved useless, and we gave up the attempt in despair. In the mean time, stones had been falling to our left, but, as I gathered, from no considerable height. We shouted for our tiffin, and took an hour's rest making new plans.

We separated. Herr Honigmann preferred to try the ice couloir that leads up straight between glacier and rock, whilst I took my way to the left, trying to get to the gallery at a lower point. Such a place I actually found at the highest point of the avalanche snow. Only 3 to 4 yards of perpendicular wall separated me from it, and with the aid of a few crevices in the rock, I got up to it. The gallery was full of loose stones, some of them of considerable size, the more treacherous of which I pushed out with my foot. It varied in width from perhaps ½ to 1½ yards. Mounting it, I thought a solution had been found, when suddenly it ended at a very steep slope made up of stones, some of which were loose and only kept in position by frozen snow. When Mahud saw this he refused to go further on, and only Kitul accompanied me. Higher up, the rock was standing perpendicular out of the slope, making it impossible to cross there. So nothing was left but to descend a few yards, and then to climb this worst part of the ascent steadily and with the utmost caution, feeling my way at every step. Happily it did not take long, and I soon reached the end of the arête, which comes down from Snow Cap, at the point where it joins the Pir glacier. Here I was pleased to see my companion only a few yards away, standing in the middle of the ice couloir. He had done about 150 steps without any mishap, but now he said he could not go on without the risk of dropping into a crevasse. We threw him a piece of rope, and a few minutes later he landed safely at our side. We now continued the climb up the arête together. The rock began to be firmer, though a few places covered with ice gave us some trouble. The snow which lies on the pass came quite close to the edge of the precipice, sometimes leaving only room for our feet on the rock, whilst our fingers had to anchor in it. The higher we advanced, however, the less snow we found, and after three-quarters of an hour's climb it narrowed and flattened so considerably that we could get on to its surface without having to cut steps—and this at a point perhaps 30 yards above the lowest point of the pass and to the west of it. Colonel Younghusband seems to have undertaken his descent by going right down from the lowest point of the pass to the point where my friend and I met, thus crossing a terribly steep ice-slope—a remarkably courageous undertaking, especially for a man who had never put his foot on a glacier before.

We had achieved our aim. After 5 hours' work, at 2.45 p.m., exactly one month after our landing in Bombay, we stood on the top of the Mustagh (= ice mountain) pass, in the heart of the Karakoram (= black gravel) Himalayas, and on the watershed of the Indus and the Tarim basin. We were delighted at our success, and considered ourselves the more fortunate as we had not expected to finish the ascent that day. Kitul was the only one who had followed us. I am sure he did not understand why we had taken so much trouble. For men to climb mountains, to deprive themselves of all comfort; not to go for shooting even, but to come so far only for the pleasure of looking through a glass and writing in a book, will always remain a deep riddle to these people. We had a splendid sky, with no cloud; the thermometer in the sun was at freezing-point; that is, 70° Fahr. less than four days before under the same conditions at Baltoro camp.

We took the following measurements with a tested aneroid (so far as they had not already been estimated):—

The Mustagh pass, about 19,029 feet, lies—

739 feet above	Mustagh circus	18,290 feet
3101 „ „	Lobsana Blangsa	15,928 „

4347 feet	above the end of the Mustagh glacier, near Lung Ka	14,682	feet
5125	„ „ Ordokas	13,904	„
7449	„ „ Baltoro camp, at the end of the Baltoro glacier	11,580	„
8729	„ „ Askole	10,300	„
11,329	„ „ Skardu on the Indus	7,700	„

A snow saddle of a few hundred yards' width forms the pass. Towards the Mustagh circus we had the steep Pir glacier, whilst on the Chinese side the valley declines gently, forming a snowy trough. At first we examined the side that was unknown to us, but unhappily the view was obscured by a dark and lofty rock chain, lying not far away. Behind this another similar chain could be seen. The valley leading to Chang Tok bears to the west, round Snow Cap, which mountain, seen from this side, is entirely enveloped in white, and shuts Chang Tok, our original destination, out of view. On the eastern side of the pass the Seven Pagodas rear their lofty towers, only leaving room for a few smaller snowfields. Between these and a broad stony mass further on we could see the end of a big glacier, apparently coming down from the Mustagh Tower, which is hidden from here by the Seven Pagodas. The finest view is towards the south. Looking down the narrow windings of the Mustagh-valley, we saw right below the junction of the Yermanendu, Mundu and Baltoro glaciers. In the saddle of the enormous arête which connects Masherbrum with its rivals to the east, we observed in the far distance the white shoulders of a very large snow mountain. Right opposite to us, huge masses of ice clinging to Neptune threatened death to anything in their way. For the first time the rarefied air began to affect us, as we could only take from ten to twenty steps in the deep snow without stopping or taking breath.

It had been impossible to persuade the coolies to follow us, and, in fact, for a man with a heavy load it would have been difficult in any case. After a short stay we began the descent, considering the possibilities of fastening ropes to help up our men. After three-quarters of an hour we gained the upper part of the gallery, glad now to find no more difficulties in the way. For 20 minutes we descended the gallery, when from the upper part of the avalanche snow we made a glissade, and after another 10 minutes leaped a crevasse, finding ourselves at the place where we had started. Allowing double time for the ascent, this could be done in 2½ hours, and counting for the march from Lobsana Blangsa to the foot of the pass another 2½ hours, the whole ascent would take 5 hours. I might note that climbers will find much to compare between the Zinal side of the Triftjoch in Switzerland and this ascent.

Judging from Younghusband's account, the ascent from the north to the Mustagh pass should present far less difficulty. This, together with our own experience, leads us to think that, with the aid of a few steel ropes and the blasting of the rocks in certain difficult places, *the way across the pass could be reopened as a regular means of communication for pedestrians.*

The coolies had not moved a single step the whole time. We saw the impossibility of doing anything with them, and determined to return. We spread out the wood we had brought, put flour and other things we did not want to take back upon it, and made our way to the camp with the firm intention of coming back and trying again the next morning. At 5.30 p.m. we left the foot of the pass, and, roped, went down at great speed. At 7.30 about dusk we reached the entrance to the seracs, when, from some unknown cause, a row took place between our cook and a Balti, the former losing his temper and hitting the poor Balti so badly on the knee-cap that it broke. This embarrassed us considerably. Happily the moon came up, and after a good deal of trouble and risk we reached the camp at last. To calm the Balti, we were obliged to make the cook help in carrying the wounded

man also. Thus bereft of our best men, and being obliged to look after our cooking ourselves, we saw no pleasant time before us. We should have to wait long, no

ON THE ROUTE UP THE MUSTAGH PASS, WITH SEVEN PAGODAS IN THE BACKGROUND.

doubt, to carry out our plan again, and, in any case, it would be doubtful whether these terrified coolies would accompany us.

In spite of the splendid weather and all precaution taken, we had both caught colds. I spent the day in walking up the Mustagh glacier with Mahud, in order to take a few snapshots. Passing the Snake glacier the barometer began to fall rapidly, and I had not yet reached the Tower glacier before a strong south-easterly gale began to blow. In a short time the sky was clouded, and quickly I turned towards the camp. Snow began to fall, and, feeling that we could do but little more, we built a stone man (pyramid), hiding a bottle in it containing some notes on our ascent. The next morning, the snowstorm continuing, we were compelled to leave. Not knowing enough of the weather conditions so late in the year, we were afraid of getting snow-bound. In fact, with the fresh snowfall, no more rock-climbing could be attempted. We took as much of our impedimenta as we could, being heavily laden ourselves, and left the remainder behind in the larger tent, which we fixed firmly with stones. At 8 a.m. we started, and reached Mustagh Spangla after 50 minutes' walk, crossed the seracs, and passed Lung Ka at 10.30. On we went

THE WESTERN SIDE OF THE MUSTAGH VALLEY, SHOWING THE MOUNTAIN RIDGE DIVIDING IT FROM THE PIALE LUMA.

for the Baltoro glacier. How glad we were to have marked our track by small heaps of stones, as under the present circumstances we should not otherwise have got through! At 1.15 p.m. we reached Ordokas. For a little while the clouds allowed us a peep at the rocky needles, now covered with fresh snow. But soon it became worse and worse again, and an icy-cold wind blew up the valley. At 3.50 p.m. we reached Chober Zechen, went around the lake in three-quarters of an hour, and arrived at Liligo at 6.45 p.m. On the morning of October 2 it was still snowing. Leaving Liligo at nine o'clock, we arrived in Baltoro camp at 11.30 a.m. Here we met with the rest of the coolies we had left behind. The Balti told us that all through the winter the snow never lies here for any length of time. The weather continued to be of the worst. At noon we registered 37° Fahr., instead of 102° Fahr. eight days ago. If there was a proportionate difference on the Mustagh pass, the thermometer there ought to have registered −33° Fahr. To warm ourselves we built another stone man on the top of an old moraine hill, and the next morning we left for a more inviting climate.

The clouds were hanging low in the valley, and it looked very threatening. Starting at 8.30 a.m., we walked on the stony path as quickly as possible, a biting wind searching us through and through. We passed Bardumal at 2 p.m., and at 5 o'clock crossed the torrent that comes out of the Dumordo valley. The next day, after four hours' walk, we entered Askole.

After the lonely mountain solitude the beauties of the upper Braldu valley were doubly appreciated by us. For hours we walked across cornfields laid out in terraces, passed numerous villages wooded with poplars and withies, hearing from below the noise of the turbulent Braldu river rushing through a canyon, and looking up to the snow-covered peaks and wild glaciers—a lovely place, the Zermatt of the future.

Arriving at Jummu in the Shigar valley, we were glad to find a raft, of which we speedily took advantage. Constructed out of twenty-four inflated sheepskins and kept together by wooden laths, it was steered by four people sitting at the corners. At 7.30 a.m. we left Jummu, and at 3.30 p.m. the castle of Skardu came into sight. Crossing the sluggish waters of the Indus, we entered Skardu near the polo ground, where the rajah and his party were indulging in the game. Near the filthy rest-house we pitched our tents, making preparations for our way back across the Deosai. Up to now the road was clear, but any day it might get blocked by snow.

On the morning of October 9, 1903, riding our ponies, we followed the poplar avenue that leads out of Skardu. Already the leaves had changed colour and were falling. We looked back with gratitude to the Mustagh chain when standing on the top of Burji La. We had been indeed fortunate enough to obtain our desire, and could never forget the impressions brought home with us of this glorious mountain scenery.

THE DISTRICT OF JAEDEREN, IN SOUTH-WESTERN NORWAY.*

By O. J. R. HOWARTH.

This paper describes the most noteworthy of the very few districts in Norway now having a coast-line practically without any fjords or islands, though evidence will be adduced to show that this was not always the case. This is the district of Jaederen, a district little visited, wanting in the scenic attractions of the fjord coast and the mountainous districts, yet possessing interests quite peculiar to itself. We are accustomed to associate the physiography of Scandinavia with glacial action on the grandest scale. But in few other localities, if any, does the effect of glacial action so completely dominate every other feature of the country as in Jaederen.

Jaederen is in the south-west of Norway, its coastal district being served by the railway running southward from Stavanger. In this direction we have some 30 miles of absolutely unbroken low coast, as unlike the Norwegian coast at large as could be imagined. It is a shingly shore, backed by a gently undulating moory foreland, full of peat-bogs, and extending some 3 to 8 miles back to the hills which rise inland abruptly. Next, shortly before the railway reaches the village of Ogne, the character of the coast abruptly changes. There are still no islands (save a few rocks), but the coast itself becomes rocky, at first with intervals of sandy beach, not shingle, and so continues until in the neighbourhood of the port of Egersund the coast resumes its normal character, protected by islands.

The transitional piece of coast belongs to the most noteworthy part of Jaederen

* Abstract of paper read at the British Association, Section E, August 1, 1907.

district. This is an area bounded by the sea and the low foreland on the one hand, and on the other by a sharp range of hills on the north, and also by high hills, and, approximately, by the Birkrem river on the east. On and beyond these boundaries, we have the beautiful and typical scenery of Southern Norway. But within these boundaries all is completely different. From the map the impression is gained of low hills rising in rounded semi-isolated clumps, the remarkably straight valley of the Ogne river cutting through their midst, many little lakes and marshes scattered among them. Actually, practically the whole is simply a tumbled tract of naked rock, or barren moor strewn with boulders. Rarely, here and there, enough soil has accumulated for a little copse of scrubby oaks to grow, but, for the rest, the country is utterly inhospitable. Occasionally the hills, or

rather great masses or piles of rock, stand up quite boldly. Perched boulders lie everywhere, set in some cases in well-marked orderly rows running diagonally across the present general trend of the valleys, following the line of the ice-flow as one sees it laid down on maps from this portion of the great Scandinavian ice-sheet, and sometimes of immense size and poised in remarkable positions. Perhaps the most impressive feature of the district is the extraordinary manner in which the rocks are piled and riven. For example, the valley of the stream tributary to the Ogne river which drains Lintjön and Helge lakes, is at one point entirely blocked by boulders, and makes its way through a cleft between them.

It has been shown that the coast is without islands, or practically so. But the island fence did once extend thus far, and this bit of coast which has now only one small and shallow inlet which can be called a fjord, namely that of Sirevaag, had

once several small fjords, just as has the coast further south. At the southern extremity of the low foreland the lake of Bruvand lies quite close to the sea. The stream draining it crosses a narrow neck of land traversed by the railway and the road, and then enters a large lagoon, separated from the sea by a sand-dune, through which the stream cuts a shifting channel. This condition of affairs is recent, and Bruvand is a curious lake; the seaward half very shallow, with a sandy bottom, the landward half deep. It is evidently merely a blocked inlet of the sea. To the south a lofty ridge intervenes, and then follow low marshy or sandy tracts, with rocky eminences sticking up out of them, evidently once islands. Then we reach the more extensive lowland in which the village of Ogne stands. This tract bears all the evidence of being a dry inlet; for example, not very far from its head, *i.e.* about 2 miles inland from the sea, there is a sandy beach. This inlet was doubtless in part filled up by the Ogne river, which comes down heavily charged with sediment when in flood, and peat-stained from the upland marshes. The river, in fact, seems in part to have filled up its own channel, for at one point it does not flow across the plain, but winds round between what must have been the shore of the old inlet and an island close off it.

Present appearances seem to show that we have the two lakes Bruvand and Helgevand, and in the Ogne plain, but especially in the first and third, an interesting study of the same physical process at different points. In the case of Bruvand, leaving out of account the accidental seaward lagoon, we have a small fjord, now partly dry, but occupied at its upper and, as usual, its deeper end by a lake, which also, as has been said, is deep at its head, but very shallow at its lower end, and, as a whole, pretty certainly filling up. Now the Ogne river, debouching into what may be called the old Ogne fjord, is a much larger stream than that which feeds Bruvand, and would have already filled up the lake which appears to have existed at the head of this old fjord also. The sandy coastal tract bordering Ogne bay merges landward into a flat, fertile alluvial tract, such as may some day occupy the present position of Bruvand. The case of Helgevand is probably similar to the old fjords of Bru and Ogne between which it lies, though it is a bolder, rockier, and more irregular lake than Bruvand; it is formed of two main arms lying at an acute angle, the upper being the deeper, while a third arm now forms really a separate lake, being separated from the others at their point of junction by a reed-choked shallow over which there are stepping-stones. This therefore would have been a narrow, ramifying fjord, whereas those of Bru and Ogne would have been wide and open. Moreover, it may be observed that the stranded islands already described would have lain mainly off the mouth of the old Helge fjord, whereas the mouths of Ogne and Bru fjords would have been open as the wide-mouthed fjords of Norway generally are. It seems that one can distinguish these two types of fjord in Norway; we may contrast the very deep type, with its narrow, island-guarded mouth, such as the great Nord fjord, and Sogne and Hardanger fjords, and the numerous lesser western fjords, against the open-mouthed shallow fjords, such as Christiania, or those east of the North Cape, which have no islands outside, but may have some within. Perhaps Trondhjem fjord is transitional between the two types.

But the river is not the only cause of the drying of the Ogne inlet. At many points on the Norwegian coast, old shore-lines and similar phenomena give evidence that the land is rising, or has risen, and the fact is particularly clearly illustrated in Jaederen about Ogne. Here we have the main reason for the stranded islands along the shore, and the absence of islands off the coast, and also in great measure, no doubt, for the low boggy foreland to the north. Moreover, one can read the evidence of two movements, not only of the rising, but of a previous sinking. The heavily glaciated rocks run right down into the sea.

The varied character of the different parts of Jaederen naturally has a striking influence on the distribution of population. Except for a very few small valley farms, the rocky country is uninhabited, whereas the low coastal district immediately to the north must be one of the most thickly inhabited tracts in Norway: unattractive as it is, it is dotted with farms and villages. It must always have been so; the district has yielded a large number of early traces of habitation; and it is a fact worth noticing that about the twelfth century there were at least three churches on this short strip of coast, and they were founded from England. Ogne was one of them; the present building retains the west wall of the old, and has in it an Early English doorway, and other remains of the same period have been discovered.

REVIEWS.

EUROPE.

LIVERPOOL.

'History of Liverpool.' By Ramsay Muir. Published for the University Press of Liverpool by Williams & Norgate. 1907.

MR. RAMSAY MUIR has approached his subject in the right spirit. When dealing with a city so great and so modern as Liverpool, one is inclined to be a little contemptuous of its shadowy beginnings. In 1565, after some five hundred years of existence, the population was only seven hundred. There seems to be little connection and no real historical relation between this mediæval village and the great city as we know it to-day. Most people would content themselves with attributing the rise of modern Liverpool to its splendid geographical position in the exact centre of the British Isles. But Mr. Ramsay Muir has done well to devote the first hundred pages of his book to the mediæval period, and he emphasizes adequately Liverpool's ceaseless resistance to the feudal lords, to the king, and to the extravagant claims of Chester. These events, slight as they appear in comparison with those of modern times, are not only of antiquarian interest; they are vital to the understanding of the town's later vigour. It is, indeed, no extravagance of thought to trace step by step the development of Liverpool from the first mention of the place in Domesday Book to the year 1229, when the town acquired self-government—from 1393, the period of its greatest success in early times, to the age when her trading ships plied ceaselessly across the Atlantic.

Liverpool begins humbly as one of the unnamed half-dozen small clearings called berewicks, which the Domesday commissioners did not even think it worth their while to name. A small tidal creek "entered the Lancashire shore from the estuary, and, running inland in a north-easterly direction for nearly half a mile, enclosed a small triangular peninsula, a low ridge of ground, rising gently from the north until it reached its highest point (some 50 feet above sea-level) at the southern point or apex of the triangle, overlooking the entrance of the creek." This creek was the Liverpool pool, which until the eighteenth century (when the earliest dock was made out of its mouth) formed the dominant feature of Liverpool geography, and was probably the cause of the creation of a little town here. The Pool left the river where the custom-house now stands, and its course is marked by the line of Paradise Street, Whitechapel, and the Old Haymarket. To the south and east of it, where Lime Street, Church Street, Bold Street are to-day, the grounds lay waste as far as the boundary of the neighbouring township of Toxteth, marked by the line of Parliament Street. To the north and west of the Pool lay

the handful of mud hovels which formed the berewick of Liverpool. They probably lay somewhere about the site of the Town Hall. Mr. Muir goes on to trace the earliest geographical features, identifying them with modern streets or buildings, and giving us in this way a most excellent picture of beginnings.

He then goes on in a few brief sentences to discuss the manorial government of the settlers here located, calling them serfs, and pointing out their lowly position in an unnecessarily and not quite scientifically exact language. Things went on in this way until 1207, when King John, who did so badly for the country at large, turned the obscure hamlet into a borough, and endowed it with burghal privileges. One would like to know whether it was the king's enlightened view of the possible development of Liverpool, or the lord, or the manorial tenants who thus took the first step in the recognition of future greatness. Mr. Muir suggests that it was John's conquest of Ireland which led to his action at Liverpool, but we think there was something more than this, for the designs of laying out the new borough were definite and complete, and were obviously the result of care and thought. It was at once constituted a free port. Mr. Muir shows in an exceedingly useful way that its development as a port was dependent upon two factors—first, the close environment of an extensive industrial centre; and, secondly, the natural facilities for harbourage and protection to shipping. It is a mistake to suppose that the latter is the only factor needed in a port. Until the first was secured, Liverpool was in a very poor way. It was only when both were secured that she became great. This lesson is important in many ways at the present moment, for Southampton and Dover are repeating the same experience, and we witness how great natural advantages are counterbalanced by economic disabilities.

But commerce alone does not promise a very inspiring memory. The citizen who, in contemplating the history of Liverpool, can boast of nothing but the great increase of population and the colossal heaping up of wealth, has no sympathy with a higher ideal, and can be no sharer in the new line of development which his city has taken. The fame of Athens rests higher than that of Carthage, and Liverpool herself recognizes the fact. The city which at the present moment is engaged in erecting a great cathedral and a great university is no mere aggregation of uncultured employers and discontented employees. A new era has dawned. In 1882—after much opposition—the university college was opened in a disused lunatic asylum in the midst of a slum district. Now, by the cordial support of the city and the most generous private endowments, this insignificant beginning has grown into a fully organized and independent university, and has taken its place amongst the great seats of learning of the world. No surer sign of the new century is visible in England; no greater evidence—if any is needed—that Liverpool is abreast of the times.

A university, however, is not a wholesale remedy for all sorts and conditions of evils; and Liverpool, like all great cities of to-day, must spend an incalculable amount of energy and money in tackling the abuses which prevail within her jurisdiction. Mr. Muir emphasizes the evils especially characteristic of Liverpool, and says enough of such matters to show that, however busy the city of Liverpool has been in the past, she has greater and more difficult tasks yet to undertake.

Mr. Muir describes and illustrates several of the most important topographical features, namely, Liverpool Tower; the old Custom-house; Liverpool in the Seventeenth Century; Liverpool, from Duke Street; London Road and the Gallows Mills; the Old Dock and Custom-house; the Old Fort on the North Shore; Lord Street—all of these are W. G. Herdman's drawings, which were based on earlier material of the eighteenth century. The most interesting of the others are Liverpool Castle ("an attempt to recover the plans of the Castle of Liverpool," by the

late Edward W. Cox); the Tower and Old St. Nicholas (c. 1750); Shaw's Brow and St. George's Hall (1849); the conjectural map of Liverpool in the fourteenth century; map of Toxteth Park (1769); and the map of Liverpool in 1725. These illustrations, drawn from original sources, are additions of considerable value to the book.

Altogether Mr. Muir travels over his ground most admirably. His care for detail does not mislead him in the grasp of great essentials, and we read through his chapters with considerable interest. They deal with the Berewick of Liverpool, 1066–1207; the Foundation of the Borough, 1207–1229; the Baronial Lords of Liverpool and the Building of the Castle, 1229–1399; the Life of Liverpool during the Middle Ages; the Anarchy of the Fifteenth Century; the Age of the Tudors, 1485–1603; Trade and Society in Tudor Liverpool; the Beginnings of a New Growth, 1603–1642; the Three Sieges, 1642–1660; the Beginnings of Modern Liverpool, 1660–1700; Rising Prosperity, 1700–1756; the Slave Trade, 1709–1807; the Age of Wars and Privateering, 1756–1815; Inventions and Commercial Advance, 1760–1835; Civilization in Liverpool, 1760–1835; and the Nineteenth Century, 1835–1907. There is a fairly good index, and a useful note on the authorities used.

L. G.

The Shores of the English Channel.

'Les Falaises de la Manche.' By Jules Girard. Paris: E. Leroux. 1907.

M. Girard describes the shores of the south side of the English Channel in a very interesting way, without too much of topographical detail, but constantly keeping in mind the processes of coast erosion which they exemplify. Perhaps the author is at his best when treating of the noble chalk cliffs, which are so conspicuous features of this coast. He analyzes their characters, pointing out how the structure and composition of chalk, together with the action of tides, storms, shore currents, winds, and weathering generally, explain the varied scenery. Beautiful illustrations from actual photographs are given, and are in themselves a rich set of object-lessons. To English readers the work also is of value as a guide to the development and history of our own shores; those familiar with the white cliffs of Albion will have no difficulty in recalling instances which correspond exactly to those adduced from the French coast. A long chapter is devoted to the loss and gain of land by the operations of the sea—a question which is at present engaging the attention of a royal commission in England—and it is pointed out that so long as the sea-level remains constant, as it seems to have been for a considerable time, the loss at one place about equals the gains at another. The rapid obliteration of old harbours and the difficulty with which many of the modern ones are kept open are also the subject of some interesting remarks.

J. S. F.

ASIA.

Moab.

'Arabia Petræa. I. Moab.' By Alois Musil. *Illustrated.* Pp. xxiii. and 448. Vienna: A. Hölder (for the Vienna Academy of Sciences). 1907.

The appearance of yet another work claiming to give an exhaustive description of Arabia Petræa can only occasion regretful surprise. Why, one inevitably asks, was not the author's material embodied in the great work of Brunnow and Domaszewski, which was published long after Dr. Musil's journeys were ended? Why, if that were impossible, does the latter's book appear now, as if 'Die Provincia Arabia' did not exist? There is a reference to Brunnow and Domaszewski's work in Dr. Musil's preface, but no account is taken of it in his text. Nothing

is omitted, because it has been described already in 'Die Provincia Arabia;' nothing is shortened, and very little is added. To all intents and purposes, Dr. Musil aims at doubling the earlier book. His preface reveals the fact that the more reasonable and useful course had, indeed, been suggested to him, and that he was at one time in negotiation with Dr. Brunnow; but the negotiation was broken off, it is not said why. If individual or national *amour propre* influenced the decision, it is much to be regretted for everybody's sake.

Dr. Musil went to the Holy Land as a theological student in 1895, and travelled beyond Jordan for the first time in the following year. Between that date and 1902 he wandered widely in southern Syria, exploring chiefly the districts of Petra, the Hauran, Moab, and Ammon, but going as far afield as Tadmor on the east, and Jebel Ansariyeh on the north. He acquired a thorough knowledge of Arabic, and learned the ways of the trans-Jordanic tribes, and thus was enabled, in 1898, to discover the interesting paintings of Kuṣejr 'Amra, which he has published in a separate volume. Gradually increasing his surveying-plant, he succeeded in the end in making a new map of Arabia Patræa, in which many of the blanks of the Palestine Survey are filled up.

The present volume is mainly a record of routes, with views (usually very good) and brief descriptions of the main wayside features. The interest is chiefly antiquarian, as is inevitably the case with almost all books on the trans-Jordan country; and it is rather to ancient than to modern geography that the author contributes. His map, however, is a very careful and welcome piece of cartographical work. Dr. Musil is a firstrate explorer, thoroughly qualified by preliminary training, indefatigable and accurate in the field; and no survey made by him would be superfluous. Our only regret is that there should be two books on one region, largely repeating one another, made out of material which, thrown into one melting-pot, had made a greater book than either.

Sinai.

'Die Halbinsel der Sinai in ihrer Bedeutung,' etc. By Prof. Dr. E. Dagobert Schoenfeld. *Map and Illustrations.* Pp. viii. and 196. Berlin: Dietrich Reimer. 1907. *Price 8 marks.*

This book is based on a journey made in 1903 from Egypt to the Catherine monastery in Sinai, and thence northwards by Nakhle to Hebron in Palestine. The author, Dr. Dagobert Schoenfeld, had had previous experience of Arab travel both in Barbary and in the northern Sudan. The object of his book is mainly to support traditional and pre-critical views of the Israelite wandering. The first part of his journey led the author over beaten tracks, the second part through a region of little interest. The whole did not show him enough of the peninsula to enable him to make any notable addition to our knowledge of it. How far he rehabilitates old identifications of the stations in the Wandering we must leave to others to decide. The style has a tendency to inflation, and the author's interest lies too much in trivialities and personal matters.

India.

'The Imperial Gazetteer of India: The Indian Empire.' Vols. 1, 3, and 4. Clarendon Press. 1907. *Price 6s. net. each vol.*

It is doubtful whether any work descriptive of a single country, in the political sense, has ever been conceived and carried out on the scale of the Gazetteer of India, the general scheme of which was devised and set in operation by the late Sir William Hunter nearly forty years ago. It may be added that no country needs a work of reference of this sort more than India, which contains, probably, the maximum of variety, both ethnical and physical. The foundation of the whole undertaking is a

very complete account of each District, and, as far as information is available, of each State. In some cases this was prepared by an experienced local official for each unit independently, on the lines set forth in the general scheme; elsewhere, the collection of materials and their subsequent compilation were entrusted to a single editor for the whole province. For current use in India itself, it is this part of the work which is of the most practical importance, and many an official, posted to a part of the country with the geography, products, population, and languages of which he is unfamiliar, has been deeply grateful for the knowledge thus imparted, and also, perhaps, for many a pleasant hour of solitary camp-life, spent in the perusal of volumes both interesting and often of high literary and scientific value. The topographical and historical cream of this Provincial series was then skimmed off into the Imperial compilation, with the addition of the general sketches contributed by the accomplished editor himself. The first edition of the latter series, in nine volumes, was issued in 1881, followed, six years afterwards, by one in fourteen volumes. Much has been learnt and much has happened in the last twenty years, so it is not to be wondered at if that number has now grown to twenty-six.

To readers in this country, the Gazetteer is chiefly known through the general summary entitled "The Indian Empire," which Sir William Hunter was happily inspired to publish separately in 1893, and which, though deprived by its bulk of the claim to be considered a handbook, has ever since its publication been the *vade mecum* of the cold-weather tourist, and the popular source of information about India amongst inquirers at home. The work under review is the expansion of this volume of 850 pages into four, of between 500 and 600 pages each. Those already published are respectively entitled Descriptive, Economic, and Administrative. The second volume, dealing with the History, is not yet out, and the editor, Mr. J. S. Cotton, observes in his general Preface, that, whilst the rest of the work has been completely rearranged and rewritten, the portion relating to the history of the British connection with India, into which his predecessor, as is well known, threw some of his very best work, will be reproduced almost untouched. The great expansion of the treatment of the different subjects has led to the substitution of signed monographs by specialists for the concise summaries by the editor, which formed the earlier work. This plan has its merits, in that the statements made go forth with all the weight of recognized experience, and, at the same time, since no single individual "knows India" in its widest sense, the colouring imparted by extensive provincial knowledge, or by strong personal views upon subjects not altogether beyond controversy, can be duly discounted, if it chance to have intruded into the narrative. It is not to be inferred from this last remark that the bias in question is other than exceptional, merely that it is not entirely absent from the text. It is possibly to the relegation of the subjects to different hands that may be ascribed the difference in the dates up to which the statistical information is incorporated; but the editorial portion of the respective chapters generally quotes more recent figures, and the whole may be considered up to date, as is only to be expected from a highly efficient, albeit—according to Mr. Morley—a somewhat "soulless" bureaucracy.

The wide field included under the heads of Economics and Administration scarcely come within the scope of this review. Just now, however, it is worth while to call attention to the accounts herein given of the place occupied by the village organization in the life of the Indian masses, and, again, to that of the position and responsibilities of the Collector or head official of the district. In the remarkable detachment of the former from the general currents of political development, and in the embodiment in the latter of the personal authority upon which British influence has hitherto rested, are found keynotes which are too liable to

become inaudible amidst the hum of the modern city and the scarcely less continuous outpourings of legislative Councils and the like. In the first or descriptive volume will be found the matter most germane to the interests of this *Journal*. Mr. Cotton should, in the first place, be congratulated upon the excellent map he has secured from Mr. Bartholomew, which is up to date, clearly printed, and not overcrowded with place-names. The geographical part of the Gazetteer, with which the work opens, is from the hand of Sir T. H. Holdich, and is derived mainly from his larger work on the subject, which was reviewed in this *Journal* in 1905. It is unnecessary, therefore, to say that the treatment is adequate throughout. He does not limit the title India, it may be noted, to the territory south of the Himalaya, but applies it to the mountains and plains to the north, east, and west of that system, making it co-extensive, in fact, with the sphere of British influence in that portion of Asia. In so doing he is undoubtedly right, as, in addition to the political considerations involved, modern geology and meteorology both point to this expansion as denoting the true barrier between India and the rest of Asia.

The chapters on these two subjects are written by Mr. Holland and Sir John Eliot respectively. India, says the geologist, is emphatically the land of paradox, from the point of view of his special branch of science, and in the description here given, the author does his best to correlate the features of the two main divisions of the country with the equivalent stages in the European standard scale. In the course of this attempt he introduces a series of group-names, which appear from a footnote to have been adopted by the consensus of Indian geologists. It is open to question, however, whether terms primarily belonging to philology, such as Dravidian and Aryan, are quite appropriate to geological phenomena, especially as in the tract known linguistically, and in a secondary sense ethnically, as Dravidian, there is said to be no trace of the fossiliferous strata for which this name is proposed by the geologists. Nor, again, is the chronological sequence implied by the application of the term Aryan to the later formations, from Cuddalore and Burma to the Himalaya and Baluchistan, easily recognizable. Purána, it is true, colloquially connotes age in the present day, but the term is already allocated to literature of a date far more modern than that generally known as Aryan. How much of India is peninsular and how much continental seems to be an open question. In the geological as in the geographical chapter, all south of the Himalaya is accounted peninsular. Meteorologically, however, that term applies only to the portion south of the Vindhya, and this subdivision seems to be supported by ethnography and history, which, allowing for the usual belt of intermediate conditions, point to the differentiation of Gangetic or Continental India from the well-defined triangle tapering southwards from it. The sixty-five pages on botany, by Sir J. D. Hooker, are a welcome substitute for the couple of pages to which the subject was restricted in the earlier edition, and the same may be said of the chapter on Zoology by the late Dr. Blanford, which shows a similar advance upon its predecessor. The Population is dealt with by Mr. Gait, probably the best authority in India, with all the experience of two Censuses to guide him. Dr. Grierson, who writes the account of the Languages, is the head of the Linguistic Survey, but might more correctly be described as the survey itself, for the greater part of the work is his. Religions, too, are as comprehensively treated by Mr. Crooke as can be done within the space of about forty pages. The value of the work, as a whole, has been incalculably enhanced by this more liberal treatment of its principal subjects, and far more exacting personages than the "ordinary reader" will find that they need not go beyond it for all the information they are likely to require about the Indian Empire.

J. A. B.

AMERICA.

Ethnology of British Columbia.

'The Native Races of the British Empire. British North America. I. The Far West, the Home of the Salish and Déné.' By C. Hill-Tout. London: Constable. 1907. Pp. xiv., 263. Size 9×5 inches. *Price* 6*s*.

The task of describing the Salish and Déné tribes of British North America could not have been entrusted to safer hands than those of Mr. Hill-Tout, who lives in British Columbia, and for a long time has spent a part of every year among the Indians of the country. His work is already well known to anthropologists, his linguistic studies being particularly valuable. Knowing the people so well, Mr. Hill-Tout, in the book under notice, has succeeded in giving, without going into too great detail, a most readable and at the same time valuable account of the manners, customs, and physical characters of the Salish and Déné peoples. The physical character of the natives is particularly interesting, as, while some of the Indians are of the regular North American cast of countenance, others approximate to a Mongolian type. Generally it is the coastal group which is more distinctly Mongoloid, and this perhaps is only what would be expected. Mr. Hill-Tout is particularly good in his chapters on technology and social customs, but where all is good it is difficult to pick out any part for especial praise. The net result is an admirable and sympathetic account of a most interesting people.

The illustrations are excellent, but it is a pity that the publishers could not have seen their way to give a better map. In a book dealing with two only of the Indian peoples, and those two among the most westerly, it is unnecessary that the map should show the position of all the linguistic stocks of British North America. A map of Western Canada, which could have been produced on a larger scale, would have been far more useful. It is also unfortunate that the titles on the cover are not the same as that on the title-page. To call the book 'British North America' on the back, and 'North America' on the side, both titles being insufficient, is not only inconsistent, but misleading.

Peru.

'The Andes and the Amazon. Life and Travels in Peru.' By C. Reginald Enock, F.R.G.S. London: Fisher Unwin. 1907. Pp. 370. *Maps and Illustrations. Price* 21*s. net.*

The author of this work is a young mining engineer who has travelled over various parts of Peru to report upon the mineral products in several mining centres. Mr. Enock is an accomplished traveller, an excellent observer, a daring explorer, and one who, while noticing the physical aspects of the regions through which he travels, is also alive to the halo of romance that covers and surrounds them. A traveller without imagination loses more than half the pleasure and interest of his journeys. But with that gift Mr. Enock is richly endowed, and to it we are indebted for his picturesque descriptions of scenery, and for the reflections arising from a contemplation of the magnificent works of nature with which he was surrounded.

The author appears to have resided longest in the very interesting Andean valley known as the Callejon de Huaylas, whence he undertook excursions into the valley of the Marañon. He also made a gallant attempt to ascend the lofty peak of Huascaran. The chapters describing these journeys are the best in the book; but there are others which will be valuable to future travellers, especially if they are connected with mining investigations. There are chapters which give details

respecting the mineral wealth of Peru, and useful hints on equipment and arrangements for journeys in the Andes.

The accounts of Incarial ruins actually visited by the author are exceedingly interesting. Chavin, as Mr. Enock truly remarks, calls for closer and more detailed examination. He gives a photograph of the very intricately carved stone of Chavin, now at Lima, upon which much has already been written, and which forms an important link in a chain of evidence. The original plate illustrates the learned paper on the stone of Chavin by Don Jose Toribio Bolo (Lima, 1900). The author's visit to the ruins of Huanuco has resulted in one of the best existing accounts of those remarkable edifices. The ruins, with the remains of columns, at Incahuasi have already been fully described.

Mr. Enock appears to have made three other expeditions—one along the coast north of Mollendo, visiting the valleys of Camana and Ocoña; another to the famous quicksilver-mines of Huancavelica; and a third to see the gold-mines of Aporoma and Poto. In his coast journeys he gives a good description of the desert *medanos*, though he cannot be complimented on the illustration. His descriptions of the *llocllas* or fan-shaped deposits at the openings of mountain gorges, and of the appearance of an authelion, deserve attention. The journeys to Huancavelica and Caravaya appear to have been very hurried, and his more detailed reports of the mines of those regions are presumably confidential.

It is pleasant to read Mr. Enock's kindly and generous appreciation of the good qualities of the Peruvian Indians. He has a favourable word for their industry as agriculturalists, as well as for their skill in the production of textile fabrics and cleverly designed pottery. Of a poetical and imaginative habit of thought, the Indians are fond of music and of singing their love ditties and *yaravies*. They have good qualities, as Mr. Enock testifies, and are hospitable and faithful when their confidence is once gained.

A great part of this portly volume is occupied with extracts from works on Inca civilization, on the Amazonian Indians, and other subjects with which the author is not personally acquainted; and it was, we think, a mistake to derive all his information respecting the Incas from an author of the eighteenth century, instead of going to the original authorities, which are now easily accessible both in Spanish and English. But for the chapters containing Mr. Enock's personal observations and his own experiences we have nothing but praise.

The map which accompanies Mr. Enock's book is inaccurate, especially as regards the course of the river Paucartambo, yet no doubt it is based on the latest available information. This is one more proof of the urgent need there is for the preparation of an authoritative map of the eastern slopes of the Peruvian Andes.

GENERAL.

Life of Captain Cook.

'Captain James Cook, R.N., F.R.S., "The Circumnavigator."' By Arthur Kitson. London: Murray. 1907. *Maps and Illustrations. Price* 15*s. net.*

The appearance, in this volume, of a connected narrative of the life of the greatest English navigator is to be heartily welcomed. Strange as it may appear, in view of the copious literature on the subject, such an account, based on the most trustworthy first-hand documents, has never before existed, most writers having been content to copy the often inaccurate 'Life,' by Kippis, or the narratives by Hawkesworth and Douglas, which, as is well known, were interlarded—especially the former—with the personal opinions and reflections of those editors. Mr. Kitson has applied himself to all the available original sources, including

the Admiralty papers preserved at the Record Office, and by a judicious use of published material as well, has for the first time placed in a true light the whole career of the navigator, so far as data exist for the portrayal. The amount of careful labour expended on the work must have been very great, and the author has evidently spared no pains to make the result as complete and accurate as possible. He has been able to correct in many particulars the somewhat imaginative accounts of previous writers, especially with regard to the earlier part of his hero's career. As regards the three voyages on which the navigator's title to fame must mainly rest, the actual corrections in matters of fact are not, perhaps, so numerous, or at least not so obvious, and a detailed comparison with previous narratives would be necessary to bring many of them to light. In this part of the book the author confines himself mainly to a straightforward narrative of events, and restricts the work of commentator within somewhat narrow limits. But this is a fault—if such it be—on the right side, and we at least escape the distraction of unnecessary breaks in the story.

With regard to Cook's ancestry, Mr. Kitson is inclined to think that he was of Scottish extraction, and he considers that his father must have been possessed of more education than has generally been supposed. He follows Dr. Young—the best authority for Cook's early life—in holding that the latter was never bound apprentice to Mr. Saunderson of Staithes, but that there was merely a verbal agreement without indentures. The story of the shilling stolen from his employer's till, and the running away to sea as a consequence, is shown to be quite unjust to Cook's memory, the matter having been cleared up to the satisfaction of his master, who freely abetted the boy in his aspirations after a sailor's life. Cook's entry into the Royal Navy, after his period of service with the Walkers, was, Mr. Kitson thinks, quite a voluntary act, and not the result of fear of the press-gang.

The papers in the Record Office permit us to follow with complete certainty his movements from one ship to another during the stirring times of the war with France, particularly in the operations resulting in the conquest of Canada. In the short space of two years he rose to the rank of master, the first ship to which he was appointed in this capacity (1757) being the *Solebay*, not the *Mercury*, as is usually stated. The mistake arose from the fact that there was a second James Cook in the service at this time. We do not learn much of Cook's personal work, but it is evident that he was actively and usefully employed, though the story that he piloted the troops to the landing beneath the heights of Abraham must, it seems, be given up. With the conclusion of peace came the important surveys on the coasts of Canada and Newfoundland, and the details given throw into clear relief the whole-hearted devotion to his work which distinguished the navigator throughout his whole career.

The story of the three great voyages is told in a clear and easy style, frequent extracts from the explorer's own journals helping to bring his personality vividly before the reader. His private correspondence with the Walkers and others is drawn upon for the elucidation of certain points, while quotations from contemporary writers or official documents help to throw light on various circumstances connected with the preparations for the voyages and the estimation in which the commander was held at the time. As an instance of Mr. Kitson's thoroughness, we may mention that after quoting from Dr. Burney's 'Memoirs' a statement that Cook had marked his own route in pencil on his (Dr. Burney's) copy of Bougainville's map, he is able to inform us that the pencil-marks on the chart (now in the British Museum) are as distinct as when they were first made. Due prominence is given to Cook's services towards the stamping out of scurvy, while the extracts relating to the organization of the third voyage, and the circumstances

under which Cook was led to sacrifice his well-earned rest by volunteering for the command, are of particular interest. The account of the tragic end to his career does not seem to add anything to our previous knowledge, though it is useful to have the most authoritative version placed on record, when so many conflicting statements are current. It is in regard to the geographical aspects of the voyages that a somewhat fuller commentary might have been acceptable. Little attempt is made to discuss the position of geographical knowledge at the opening of Cook's career of discovery, or to sum up the total additions to such knowledge which resulted from it. While touching on the search for Bouvet island, we might have expected the author to refer to its eventual discovery, only a few years ago, by the *Valdivia*. He does not seem aware of the existence of the club, once in the possession of Sir J. Banks, by which Cook is said to have met his death, nor of the monument lately erected to his memory by a French admirer at Méréville. Elsewhere he shows himself fully informed on subjects of recent discussion. Thus he successfully defends Cook's claim to priority on the east coast of Australia against Cardinal Moran's fantastic theory of its discovery by Quiros. And it would be ungracious to dwell upon possible omissions, which are certainly few and unimportant, while, taken as a whole, the author has done a most creditable piece of work, for which he deserves the gratitude of all students of geographical discovery.

The illustrations are well chosen, and consist almost entirely of photographic reproductions of contemporary documents, portraits, and drawings. The two portraits of Cook are those preserved in Greenwich Hospital and in the Whitby Museum, the former by N. Dance.

A Pocket-book for Travellers.

'Scouting and Reconnaissance in Savage Countries.' By Captain C. H. Stigand, F.R.G.S., F.Z.S. London: Hugh Rees, Ltd. 1907. *Price 5s. net.*

Under the above title, Captain C. H. Stigand has produced a little handbook, which gives a great deal of information of a very practical nature in connection with matters that cannot fail to be of importance, not only to the scout in a hostile country, but to all pioneers and explorers. To begin with, there are useful hints on finding the time and direction by means of rough bearings of the sun, stars, and moon, which, though not pretending to scientific accuracy, should be of assistance to any traveller unprovided with instruments who may be hurrying through a wild country. This is followed by a chapter on "Landmarks and General Information," another on "Tracking," which contains many good tips for following up and recognizing the spoor of various animals and men. After this follows a chapter of "General Hints," one on "Tribal Customs and Differences," followed by one on "Reconnoitring Hostile Kraals or Villages." There are also two appendices, the first of which gives instructions for using the star maps which are placed in pockets at the beginning and end of the book, while the second suggest various "Exercises for Scouts," to assist in observing and noting events, and facts that may prove of importance later on. Among the books consulted, Captain Stigand specially mentions the Society's 'Hints to Travellers,' and for more exact information on all the astronomical matters dealt with this should be referred to.

The little work is strongly bound in pocket-book form, and at the end contains blank pages for notes and for keeping a rough field book.

SHORT NOTICES.

Asia.—'Wanderings East of Suez.' By Frederic C. Penfield. (London: George Bell. 1907. Pp. xvii., 349. *Illustrations.* 10*s.* 6*d. net.*) In part this book partakes of the character of those written by "wanderers" with no particular purpose, save

that of superficial observation. In common with such works, it has the familiar "catch" headlines to its chapters; among these "The World's Turnstile at Suez" deserves notice, as it gives a clue to the author's deeper purpose, that of commercial interest. His notes upon Asiatic trade in various aspects are the valuable features of the book.

'The Chinese Language and how to learn it.' By Sir Walter Hillier. (London: Kegan Paul. 1907. Pp. vi., 263. 12*s.* 6*d.* *net.*) This is a handsome volume of its kind, giving evidence of very careful production. The explanatory chapters on the written and the spoken language of China are clearly intelligible, even to those who approach the subject without knowledge.

America.—'Sunshine and Sport in Florida and the West Indies.' By F. G. Aflalo. (London: T. Werner Laurie. 1907. *Illustrations.* 16*s.* *net.*) Plenty of pleasant description of travel, not only in Florida and the West Indies, but also elsewhere, as in Panama at the canal works, and in Colombia; plenty of scientific advice and narrative in the matter of tarpon fishing and other sport, including notes as to the geographical distribution of the tarpon; plenty of beautiful illustrations—these features go to the making of an entertaining volume, such as should be expected from its author.

General.—'Bradshaw's Through Routes to the Chief Cities of the World.' (London: Blacklock. 1907. Pp. xlviii., 656. *Maps.* 5*s.* *net.*) This well-established guide now reaches its fifty-first anniversary. Though its indications of great main routes are thoroughly worked out and carefully selected, it may be felt that the brief notes which bring the book into competition with the ordinary guide-books are a less satisfactory and essential feature. As regards the United Kingdom, "a supplement has been introduced dealing succinctly with the chief watering-places and health resorts of the British Isles." It is not a little surprising to learn that Oxford ranks among these; on the other hand, any attempt to reckon up the omissions from the list, or to imagine the system on which it has been selected, makes it impossible to congratulate the editors on this new feature.

'Geography in Relation to War.' By Colonel E. S. May (London: Rees. 1907. Pp. 61. *Maps.* 2*s.* *net*). This small book consists of "two lectures on military geography delivered at the conference of officers of the General Staff at the Staff College, and to the members of the Royal Artillery Institution respectively." Each several point in which geographical knowledge or instinct is of value to the soldier is lucidly set forth, and illustrated where necessary with historical examples, which in a few cases are themselves clarified by sketch-maps.

THE CIVIL SERVICE EXAMINATIONS.

During the past month a step has been taken of incalculable indirect importance to the diffusion of geographical knowledge in this country. The Civil Service Commissioners have announced that after next year geography, treated scientifically, will be added to the list of subjects which may be taken up in the open competitive examinations for clerkships in the upper division of the civil service. This step must inevitably be followed, sooner or later, by the subject being made compulsory on candidates for several of the public departments.

It will be remembered that for years geography was one of the

subjects for candidates for the Foreign Office, which had its own special examination system, distinct from that for the remainder of the civil service. Last year notice was given that this special system was to be abolished, so as to bring the Foreign Office examinations, in their main features, into line with those of other departments. The change, however desirable in other ways, was a retrograde step as regards geography; but it furnished an excellent opportunity for bringing about a general advance in a more rational and practical direction. This movement, however, demanded preliminary action on the part of our older universities, for the Civil Service Commissioners naturally asked that they should take the lead in so important a matter; and in view of the careful consideration which these great institutions very properly give to any important changes, it is a matter of congratulation that our geographical campaign should have been brought to a successful issue within a year after it was opened. All who believe in the necessity of England rising to the level of Germany and the United States in the spreading of geographical knowledge, will be grateful to Oxford and Cambridge for the important part which they have played in this reform, as also to the *Times* and other organs of the press for the whole-hearted support they have given to it.

GEORGE TAUBMAN GOLDIE.

THE MONTHLY RECORD.

EUROPE.

Altitudinal Distribution in the Venetian Alps.—The study of altitudinal distribution, to which a new impetus has been given within recent years by the work of Ratzel, Bruckner, and others, is being taken up in various quarters.* In Italy the principal worker in this field is Prof. O. Marinelli, who has treated very fully of the various altitudinal limits in the Alpine district of Comelico in the first issue of the *Memorie Geografiche*, a new series of monographs intended as a supplement to the *Rivista Geografica Italiana* (Florence, 1907). The writer begins by a general discussion of methods, and lays stress on the need of modifying these to some extent according to the special phenomenon under investigation. Thus he differs from Ratzel in holding that, while in the case of physical factors such as snow and ice it may be desirable to lay down a "climatic" limit, in addition to the "orographic" limit actually existing in definite regions, such an abstraction cannot usefully be called into play in the case of anthropological distributions, in the determination of which so many special factors have to be considered. As regards the method of accumulating the data, for which some students have had recourse to existing official maps rather than to an examination of the ground, he points out that the Italian maps do not present the facts with sufficient precision to allow this to be done. Even observations made on the spot for the purposes of the research are frequently unsatisfactory, and Prof. Marinelli admits that much of his

* Dr. R. Sieger's suggestions respecting research in one special branch of the subject were the subject of a note in the November number (p. 537).

own previous work has lacked the desired precision. The limited district to which he has devoted much attention during the past two or three years—comprising the extreme upper basin of the Piave—is well fitted for such a study, as it forms on the whole a well-marked natural unit, though the administrative limits do not entirely coincide with the natural ones. Prof. Marinelli paid special attention to the distribution of population, and after dealing with this in a general manner, he discusses in turn the altitudinal limits of permanent habitation, and of the various forms of temporary settlements which here, as in other parts of the Alps, play so important a part in the life of the people, although in Venetia they do not show quite the same characters or importance as in the more western parts of the Italian Alps. The "stavoli," or chalets, are usually inhabited during the spring and autumn, though some are used during the summer also, and some do not serve as sleeping-places at all. As a result of observations in a number of different localities, the mean height to which they reach comes out as 1419 metres (4650 feet), or only 100 metres greater than that of the permanent habitations. "Fenile," or barns for the storage of hay (inhabited only during the hay-harvest), reach a mean altitude of 1686 metres (5530 feet); while the "casere," or communal cattle-stations, used only during the summer, extend higher still (1755 metres, or 5750 feet). The limits of the various forms of cultivation (which are closely related to that of the "stavoli") are also estimated, as also of trees and shrubs under various conditions, and of the glacier-fronts and permanent snowfields, though the observations do not permit a satisfactory determination of these. As regards exposure, a southerly aspect is particularly effectual in raising the limits in the case of human settlements, while a westerly seems generally preferred to an easterly one.

ASIA.

Physical Features of Sebu.—A series of papers on the physical geography of the Philippine islands, to be contributed by W. D. Smith to the *Philippine Journal of Science*, opens with an account of Sebu island (vol. 1, No. 10). The letterpress is illustrated by eight plates. Sebu is the oldest place of European settlement in the group, and, for its size, the most populous of the islands. The building of over 100 miles of broad-gauge railway, the possession of coal and oil, and the recent freeing of its port, encourage Sebu to look forward to increasing prosperity. The core of the island is largely plutonic, overlaid by a conglomerate of varying thickness. Its backbone is formed by the Central Cordillera, running north and south, in line with the longer axis, and rising to over 3000 feet; partially wooded, and, save for scattered bands of ladrones, almost uninhabited; a region of very pronounced relief underlain by igneous rock, supporting a rather scanty flora, and eschewed by the natives. In isolated portions, thanks to a capping of coralline limestone, the range has an even crest, but elsewhere, as in the region of Mount Maupa, south-west of Sebu city, the outline is serrated. The main folding in the island having an east-to-west direction, its axis runs north and south, the same direction being exhibited by the streams in the vicinity of the Cordillera. This is, however, modified by a minor north and south folding. Between the cordillera and the coastal plains are the "intermediate uplands," their surface rock mostly limestone or marl. These uplands maintain a scantier population than might be expected, the natives in the centre living huddled in squalid barros. Corn, the principal crop, is indifferently cultivated. Sebu's best land is in the valleys of the Pandan, Jakupan, and other streams, broad and flat-bottomed valleys with floors about 150 feet above the sea. Nearly nine-tenths of the enormous population of Sebu crowds the exceedingly narrow and interrupted coastal plains, where, on a coral reef foundation, is deposited very varied *débris* from the hills, a rich compound

of diorite, andesite, basalt, sandstone, and limestone. The stiff paddy clay holding the water round the roots of the plant, rice here enjoys a most congenial habitat, and the coconut flourishes along the littoral. In the coves (*cuencas*) are the sugar *haciendas*, the great cornfields and vegetable gardens, but, from want of an impervious substratum, very little rice. The social and political trouble which has harassed the island is attributed to the crowding of a people of primitive civilization on the narrow margin of alluvial plains offered by the island.

AFRICA.

Hydrography of the Nile in 1906.—Continuing his invaluable researches on the hydrographical system of the Nile, Captain Lyons has issued (as *Survey Department Paper* No. 2, Cairo, 1907) a monograph on the 'Rains of the Nile Basin and the Nile Flood of 1906.' Before coming to the particular records for 1906, he discusses briefly the present position of the machinery for recording the data, and the normal distribution of the rainfall in time and space. The recent establishment of meteorological stations, both in the Sudan and in the equatorial regions, has placed the whole question on a much firmer basis, it being now possible to follow the course and intensity of the rains through the whole of East Africa from Nyasaland northward to the limits of the monsoon region near Dongola and Berber. It is from Abyssinia and the region to the south that further records of the rainfall are most needed, for when the heavy rainfall of July and August has set in, the conditions of the surrounding regions give but slight indications of the variations on the tableland, where a break lasting ten days may reduce the volume of the whole flood by ten per cent. The information received by telegraph from Addis Abbaba, and from Addis Ugri in Eritrea, was, however, of the utmost assistance for the forecast of the flood, while the number of lake and river gauges now working in the Nile basin are another most valuable aid. A qualified meteorologist was to be sent to Addis Abbaba during 1907, and it was also proposed to investigate the upper currents over the Sudan plains by means of kites, so that a still better knowledge of the factors in the development of the flood will be gained in course of time. After seven successive years of deficient flood, a flood of more nearly average volume was recorded in 1906. The low-stage supply of the spring months was greatly improved by heavy rainstorms in Abyssinia and the Southern Sudan during February and March (quite an unusual occurrence), and though the regular rains were rather late, and at first weak, matters improved so much in July, August, and September, that the flood could eventually be characterized as "fairly good." Captain Lyons illustrates the normal distribution of the rains throughout East Africa by a series of charts referring respectively to the three seasons in which most of the rain falls, and to the year as a whole. The first shows the distribution for the period March to May, corresponding to the first rainy season on the lake plateau; the second, the rainfall of June to September, being that which supplies the Nile flood, and is of primary importance to the Sudan; the third, that of October to December, the second rainy season of the lake plateau. The mean monthly rainfall is also given by means of tables for a large number of stations in or near the Nile basin. The bulk of the paper consists of a minute analysis of the rainfall and Nile-flood of 1906, and a discussion of certain special subjects, one being that of the low-stage supply of the Nile, which has been studied with much care by Mr. J. I. Craig. New light has been thrown on the seepage from the Nile into the Nubian sandstone, by which it seems clear that a very large quantity must be lost, though some is probably returned when the level of the water-table becomes higher than that of the river surface. It has also been shown that, owing to the rise of the Blue Nile, a large body of water is pounded back in the valley of the White Nile, and forms a

reserve which is drawn upon when the Blue Nile falls. The level may be temporarily raised by rainstorms during the months November to April, though these are of comparatively rare occurrence. A large number of diagrams are inserted, showing fluctuations of level as recorded by gauges, and other features.

Rainfall of the Atlas Lands.—The most complete study yet made of the precipitation conditions of North-West Africa (Morocco, Algeria, and Tunis) is that of Dr. Karl Knoch, which appears in the *Jahresbericht* of the Frankfurt Association for Geography and Statistics (17 Jahrgang, Frankfurt-am-Main, 1907). It occupies eighty-six pages, and embodies in a generalized form all the data on the subject at present available. For Algeria, and in a less degree for Tunis, they are fairly extensive, and some of the series of observations extend over a considerable number of years. For Morocco the case is different, though observations have been made at certain stations within recent years, while a general discussion of the climate in general had been supplied by Dr. Theobald Fischer, to whom Dr. Knoch owes the suggestion which led him to undertake the present work. After some preliminary matter, the author proceeds to discuss the distribution of the rainfall in space and time. The most striking fact is the great variation between different parts of the region. As regards the former, it may be said that, taken as a whole, the rainfall diminishes from the coast to the interior, and also from east to west, the most rainy region of all being that of the highlands of northern Tunis, though most of the Algerian Tell is well supplied. An exception to this general rule is formed by the Atlas of Morocco, where naturally the rainfall again shows a marked increase, after falling to a low figure over the outer plateau. Taken as a whole, the Atlas region falls within the realm of winter rainfall, with dry or almost dry summer, though this does not hold good beyond a limited distance from the coast. The summer drought is especially pronounced along the whole coast of Algeria and Tunis. On an average, the largest amount of rain falls in January in western Algeria, but, further east, in December. In Morocco the distribution seems to be somewhat different, so far as can be judged from the still scanty data. In the north there is a small amount of rain even in July and August—the driest months (the most rainy month being November), while further south they are quite rainless. In this direction the amount of winter rain also shows a relative diminution. In Mogador, *e.g.*, there is a subordinate maximum in March, besides the main maximum in December. With the increase in height as we go inland, the summer drought is moderated, while throughout the whole interior the spring is the most rainy season. A section of the paper deals with the water-supply of the rivers, which varies greatly in different parts of the region and at different times of the year. Most of the rivers reach a very low level during the summer drought, unless they are fed from the region of spring rainfall or from melting snows. Morocco, owing to the greater height of the Atlas towards the west, is more favourably placed than Algeria or Tunis in this respect. Another instructive section is devoted to a consideration of the relations of vegetation to rainfall, and this is further illustrated by a vegetation map on tracing-paper, which can be placed over the rainfall map. The fact that no regular cultivation is possible where the precipitation is less than 400 mm. (15·7 inches) is clearly brought out. A series of tables gives the rainfall statistics for a large number of stations, showing, *inter alia*, both the mean amounts and the percentages of the yearly total for each month and season.

The Development of Angola.—A consular report (Annual series, No. 3928) on the trade of Angola for 1906 takes stock of the present position and outlook of that Portuguese possession. Owing to the continuing depression following the heavy depreciation of coffee, its staple export, Angola, finding the littoral, to which ever since its foundation in 1575 it has been clinging, inadequate to supply its

wants, is now thrown on the resources, including immense rubber-producing areas, of its vast and still all-untapped hinterland. These neglected regions are in process of being opened up by three railways. The most important is the (British) Lobito-Katanga railway, whose objective is the Katanga mines, with their wealth of copper of superior quality. On completion, this railway will put Lobito port in communication with the Cape to Cairo railway, will connect with the Beira railway, and thus establish a trans-African line starting and terminating in Portuguese territory, securing also to Angola a share in the quickest mail route to British Central and South Africa. The line is to have a total length of about 1242 miles, and constructive works are in progress between its 37th and 53rd mile. Depopulation, however, cripples the progress of the railway, as also the Portuguese industries drained of many hands for the work of the railway. The Loanda-Ambaka line has now been extended to the 52nd mile beyond Ambaka, having still 37 miles to cover before reaching Malanje. Traffic is opened as far as Matette, 252 miles from Loanda, and is expected to be opened to Malange within a year. It is further proposed to extend the line 186 miles beyond Malange, so as to penetrate the Kwango basin, and the rich rubber-district of Lunda, and divert (it is hoped) the trade of the Kasai region from its outlet through the Congo Free State. A branch line northwards to San Salvador do Congo, to open up the Bembe copper-mines, and another from Kassalala to Dondo, are in contemplation. The Mossamedes-Chella railway has been surveyed to the 67th mile, and traffic is opened to Pedro Grande at the 42nd mile. The population of five of the six districts of Angola reached, in 1900, a total of 789,946, of whom 10,037 were white.

AMERICA.

Drift-ice in the Newfoundland Seas.—Dr. L. Mecking, whose paper on the ice-conditions in Baffin bay was lately referred to in the *Journal* (vol. **28**, p. 404), has since treated of the important and practical question of the distribution in time and space (particularly the former) of the drift-ice encountered in the much-frequented seas in the Newfoundland region (*Ann. der Hydrographie*, 1907, Nos. 8 and 9). He points out that the phenomena in question are only now beginning to be capable of scientific elucidation, owing to the almost entire absence of data until within quite recent years. Such data are now, however, accumulating, thanks principally to the monthly reports published by the German and American Hydrographical Offices, the latter of which are of most value for a study like the present. These, therefore, are used by Dr. Mecking as the ground work of his study, though it has been necessary to rearrange and co-ordinate the material in order to draw the desired conclusions from it. Some manipulation is necessary in order to show the results in a graphic form, while the reduction of the observations to a common scale for the whole period dealt with (1882–1900) has been effected by calculating the monthly amounts throughout in *percentages* of the yearly totals. Having summarized the data in suitable form, Dr. Mecking discusses briefly the relation of the ice-drift (both as regards pack-ice and icebergs) to the weather—a subject which he had already discussed in his previous study. The main result is to show a remarkable agreement between the ice-conditions of any given year and the distribution of pressure in the preceding year. Thus a steep gradient on the Labrador coast, with the off-land wind to which it gives rise, favours the southward movement of the pack-ice, while a similar steep gradient between Greenland and Baffin bay helps to bring out the newly formed icebergs from the shelter of the west coast of the former. The last and most important section of the paper discusses in detail the distribution, both of pack-ice and icebergs, within the year. It is shown that the curves for the two sorts of ice are quite distinct, for while the

pack-ice reaches a decided maximum in February, with a secondary maximum in May, the icebergs begin with a secondary maximum in March, the main maximum coming only in June. Many other interesting laws are brought out. Thus it is shown that the maximum in the case of pack-ice is developed *earlier* in a year of abundant ice than in one of scanty ice, whereas the contrary seems rather to hold in the case of icebergs. Other points discussed are the course and duration of the ice-season, the seasonal (as opposed to monthly) distribution of the ice, its distribution in space, and so forth. The comparative amounts of ice to the north and south of 45° are shown for each month, both by a table and diagrams, which bring out the fact that both kinds of ice are relatively most abundant to the south of that line in April, though the pack-ice shows a renewed southward extension in July. Dr. Mecking attempts in every case to explain the reason for the facts observed.

Orographical Nomenclature of the United States.—The United States Geographic Board has lately had under consideration the nomenclature of the major topographic features of the United States, about which no uniform usage has hitherto prevailed. In order to arrive at an authoritative decision as to the names to be applied and the exact limits of the features described by them, the board last year sent out questions to many American geographers and geologists, whose replies have been utilized for the solution of the questions. Decisions in regard to all the principal orographic features were announced in February last, being in almost every case based on a consensus of opinion on the part of those consulted. It does not appear whether the board have yet issued a report on the subject, but the decisions were communicated to the American Geographical Society at the time, and are printed in the Society's *Bulletin*, vol. 39, No. 2. Only the more far-reaching decisions can be referred to here. The entire western mountain system of North America is to be known as the Cordilleras, while the name Rocky mountains is to include the ranges of Montana, Idaho, Wyoming, Colorado, New Mexico, and Western Texas, but not the Wasatch and Uinta ranges of Utah. "Pacific Ranges" is the name chosen for the Cascades, Sierra Nevada, and Coast ranges collectively. The two first are separated by the gap south of Lassen peak, the Sierra Nevada being thus curtailed by some 120 miles relatively to common usage. The Cascades extend northward into Canada, and the Coast ranges both northward into Canada and southward into Lower California. Nothing is said as to the northward limit of the Rocky mountains, though it is to be supposed that the extension of these into Canada is taken for granted. The Appalachian mountains are held to include all the eastern mountains of the United States from Alabama to Northern Maine. Decisions are also given with regard to the Plateau region, the Basin ranges (which include the Wasatch range, but stop short of the Blue mountains of Oregon in the north), and a limited number of separate orographic units.

Mexican Volcanoes.—The little-known volcanoes of Colima, Nevado de Toluca, and Valle de Santiago are described and illustrated by Prof. H. F. Cleland in the *Popular Science Monthly* (vol. 71, No. 2). The most recently active volcano in Mexico, Colima lies west of Mexico city, 50 miles from the Pacific. With a slope of from 35° to 39°, it forms a perfectly symmetrical cone, save for the protrusion, on its north-eastern slope, of a secondary cone. The twin cones rise respectively to 12,600 and 11,820 feet. The rim of the crater of the main cone is entire, except for a depression through which lava-streams flowed in 1885 and 1903. The crater has a diameter of little over half a mile. The chief barrier to the ascent of Colima on the north side is the lava-flow poured out by the secondary cone in 1869. Owing to the more rapid cooling of the outer edge than of the centre of the molten lava-stream, the flow on the north side, rising above that of the central portion, forms a kind of wall. The central

portion, remaining longer hot, continued flowing after the cone ceased pouring out lava, thereby lowering its surface. In August, 1869, a month after the principal eruption, the lava flowed a little more than 9 feet per day. The second cone, of a compact andesite, with a steep slope, presents no crater, but only three parallel fissures at the summit. In 1877, 1884, 1885, and 1903, minor eruptions occurred. The only evidences of activity since 1903 are copious steam and gases issuing from the fumeroles. Rising to 6000 feet above the plain, or 14,833 feet above the sea, the Nevado de Toluca is surrounded at some distance only by volcanoes, which form, through accumulation of ashes and lava, an almost enclosed basin. Of easy ascent, the crater can be reached on horseback in four to five hours. The first to reach the crater was Humboldt in 1803. It has not been in eruption since historic times, and still shows no signs of activity. The crater is a mile in its longest, a third of a mile in its shortest, diameter. The Valle de Santiago includes eleven craters, occupying an area roughly circular in outline. The diameter of the craters varies from 1500 feet to more than a mile. Four of them are occupied by lakes of pure water.

The "Stone-rivers" of the Falkland Islands.—The question of the origin of the well-known "stone-rivers" of the Falkland islands has recently been raised by more than one writer, *e.g.* by Dr. Gunnar Andersson, of the Swedish Antarctic Expedition (*Journal*, vol. **21**, p. 160), and Mr. Vallentin (*Ibid.*, vol. **25**, p. 96). This has suggested to a German student, Herr B. Stechele, to undertake a careful examination of the whole subject, and the results are published as one of the *Münchener Geogr. Studien*, edited by Dr. S. Günther (No. **20**, 1906). The writer describes the general physical characters of the group, as well as the stone-rivers in particular, and then examines in detail the various explanations of the phenomenon which have been put forward from the time of Pernety onwards. He groups the possible causes under the two main headings of endogenous and exogenous forces. It was the former which were called into play both by Pernety and, later, by Darwin, who ascribed the accumulations of rocks to volcanic or seismic action. But no satisfactory evidence pointing in this direction has ever been forthcoming, nor does it seem permissible to have recourse to geotectonic processes, such as fractures or dislocations of the crust, the group having been rather the theatre of extensive folding. We are therefore forced to fall back upon exogenous forces as supplying the true cause, though, in spite of the agreement in lithological character between the rocks of the "rivers" and the quartzite formations of the upper levels, the extremely slight inclination of the valley-slopes forbid us to suppose that they have been derived from these by any of the more ordinary processes of denudation and transportation. Nor can much be said in favour of glacial transport, observers being agreed in regarding a former extensive glaciation as extremely doubtful. Dr. Gunnar Andersson speaks in somewhat vague terms of the "rivers" as due to a peculiar mode of detritus transport, associated, as in some parts of the Arctic Regions at the present day, with a thick winter covering of snow. Mr. Vallentin regarded the stone-rivers as having originated *in situ*, the rocks being laid bare by the removal of the covering of soil. The writer finds, however, that the explanation of Wyville Thompson, which supposed the rocks to have been carried to their present situations by a downward creep of the saturated soil-cover, as still the most probable, and he devotes a large part of the paper to a general consideration of this method of transport. He cites what appears to be a remarkably similar phenomenon observed in the Hunsrück by A. Leppla, the only difference being that the more or less plastic medium in which the quartzite fragments make their descent to lower levels is in this case not peat, but a disintegrated clay-slate. The objection to Thompson's theory is that we have no proof that the supposed means of transport

is effective at the present day, and Herr Stechele suggests that the origin of the "stone-rivers" may be attributed to the end of the Ice Age, when the downward movement of the blocks would be favoured by the saturation of the clays and sands by melting snow. In any case, he thinks that the phenomenon is not an isolated one, but that other accumulations of rock may have been formed in a similar way. Although the idea of accumulation *in situ* finds no favour with the writer, it seems not impossible that this may be applicable in certain cases, for, when there is an alternation of harder and softer strata, it is conceivable that the removal of the latter by slow percolation of water might leave on the surface an accumulation of rock-fragments at a lower level than that of the country on either side.

AUSTRALASIA AND PACIFIC ISLANDS.

The Magnetic Survey of the Pacific.—Prof. L. A. Bauer, one of the originators of the project for the magnetic survey of the Pacific under the auspices of the Carnegie Institution (*Journal*, vol. **25**, p. 462; **27**, p. 92; **28**, p. 184), has lately summarized, in *Terrestrial Magnetism*, the *National Geographic Magazine* (September, 1907), and elsewhere, the results attained during the first two years' work. After sailing from San Diego, California, on March 2, 1906, the *Galilee* visited Fanning island, the Samoan group, Fiji, Jaluit (Marshall islands), and Guam, from which last sail was set for Japan. At Yokohama the ship was blown on to the breakwater during a typhoon, but the damage was repaired and the *Galilee* reached San Diego on October 20, 1906. Comparisons were made between the ship's instruments and those of the observatories at Apia and Yokohama, as well as of Mr. G. Heimbrod at Suva, Fiji islands. Throughout the cruise observations of the three magnetic elements were made as frequently as the weather and sea-conditions would permit, and the preliminary reductions have shown that they attained a most satisfactory degree of accuracy. The need of the survey, both from a practical and scientific standpoint, is shown by a comparison of the charted and observed values of the magnetic elements. Between San Francisco and Honolulu the former are too small by amounts ranging from 1° to 3° in respect of declination, and by about 1° in respect of dip; while the charts of equal horizontal intensity give values too high, on an average, by $\frac{1}{25}$ part. Prof. Bauer points out that a vessel might thus, during a foggy or cloudy passage, find herself too far north by about $\frac{1}{60}$ of the distance between those two points, *i.e.* roughly, 35 miles, or enough to prevent a successful landfall. Owing to the care taken to reduce to the utmost the iron and steel used in the equipment of the *Galilee*, the magnetic constants of the vessel were unusually small, though not small enough to obviate corrections on this score, and Prof. Bauer urges the importance of securing for oceanic magnetic work an entirely non-magnetic, specially built vessel. For close-shore work it would be unsafe to dispense entirely with auxiliary motive power, but this could be supplied by a gas or gasoline engine, in which but a very small amount of steel is required.

POLAR REGIONS.

Mr. Shackleton's Expedition.—Mr. E. H. Shackleton left London on October 31 for Lyttelton, New Zealand, whence the united expedition is to sail on board the *Nimrod* for King Edward VII. Land on the first day of the New Year. Writing from Cape Town on October 4, Lieut. England reported that up to that point the *Nimrod* had encountered a large proportion of adverse winds, and had been under steam nearly the whole time. She had been tossed about a good deal,

and on one occasion Mr. James Murray, the biologist, was flung against the ship's rail with such force that he sustained a broken rib. Lieut. England expresses himself as perfectly satisfied with the vessel, and speaks of all on board in the highest terms. The voyage from Torquay to Cape Town was performed in fifty-seven days, at an average speed of about 5¾ knots an hour, the longest day's run being at the rate of nearly 8 knots an hour. While under sails alone, the *Nimrod* showed that under favourable conditions she could do nearly 6 knots an hour. On account of the adverse winds, it was found impracticable to "swing" the ship for variation once every 500 miles. The operation was carried out some half a dozen times between England and the Cape, and on various occasions the ship's boat was sent away to collect biological specimens.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Recent Earthquakes.—The month of October was marked by an outbreak of seismic activity in several distantly-separated parts of the world, and several of the earthquakes have been heard of directly, in addition to being known from long-distance seismographic record. To commence with the one nearest home, the classic region of Calabria was again the scene of a destructive earthquake, which, with dramatic irony, coincided with the date fixed for the formal opening of villages rebuilt after the shock of September 8, 1905, and again laid in ruins on October 23, 1907. The centres—for, like that of two years ago, it seems to have had several centres—of destructive violence coincided in part with those of the earlier shock. It was destructive at Pizzo, Tropea and Monteleone. The districts north of this, which were destroyed in 1905, seem to have escaped any serious damage, as also Palmi and its neighbourhood, but, further south, the shock caused damage in varying degree over the greater part of Aspromonte. Ferruzano and Brancaleone, on the eastern coast, are reported as having been completely destroyed, 228 people having been killed and 430 wounded at the former of these two places. The accounts of the earthquake, no less than the distant seismograph records, show that the shock was considerably less than that of 1905, of which it may be regarded as an after-shock of more than usual severity. At an earlier date, and in a more distant locality, a severe earthquake took place in Bokhara on October 21. The first accounts, received through Tashkent, stated that the town of Karatag had been completely destroyed, and that the governor and his mother were the sole survivors of 15,000 inhabitants; later information showed that there was a good deal of Oriental exaggeration in this, but the distant records prove that there was in reality an earthquake of the first magnitude in that region on the date of the destruction of Karatag. Another great earthquake recorded by seismographs took place on October 16. The origin lay somewhere in the North Pacific, and this earthquake seems to have got into the newspapers in the shape of a telegram dated November 8 from San Francisco, to the effect that the captain of a whaler reported that a terrific earthquake occurred in the previous month in the island of Unalaska, where "McCulloch peak, which was created by an earthquake a year ago and towered 3400 feet above the sea-level, has dwindled to nothing." There is no doubt that a very severe earthquake did occur in the region and at the time indicated, but the details are evidently inaccurate. The peak referred to is probably the new member of the Bogoslov group (cf. *Journal*, vol. **29**, p. 228), formed by a volcanic eruption last year. It was first sighted by the revenue cutter *Perry*, and known as Perry peak, but has since, we believe, been the object of a more detailed examination by a vessel named *McCulloch*. In connection with these earthquakes, though there need be no connection of a causal character, may be noticed the report of renewed activity of the eruption of Matavanu in Savaii, which commenced on August 1, 1905,

and has been more or less continuous ever since, having during this period poured out a mass of lava which, after covering a tract of country over 10 miles in length, with a breadth of from 1 to 3 miles, has filled the lagoon for a distance of 5 miles along the coast, and thrust forward several small promontories beyond the fringing reef.

Constitution and Figure of the Earth.—That the results of modern seismological observations may throw a new and unexpected light on the nature of the Earth's interior and the relation of this to its external form, has been pointed out by Mr. R. D. Oldham in communications made to the Geological Society within the past two years. The first of these, printed in the *Quarterly Journal* of that Society (1906, pp. 456–475), dealt with the difference in physical properties which seems to exist between the central core and outer layers of the Earth, as indicated by the behaviour of the earthquake waves in passing from one side to the other. In the second communication (printed in the *Quarterly Journal* for 1907, pp. 344–350) Mr. Oldham shows how similar considerations may throw light on the possible differences of constitution between the portions which underlie oceans and continents, thus supplying a much-needed help towards an understanding of the mode of origin of the former. The two great earthquakes of 1906—those of Colombia and San Francisco—had their origin in spots so placed that while in the former case the path of the earthquake-waves towards the European observatories lay in the main under the bed of the ocean, in the latter the waves ran for the greater portion of the distance under continents or the continental shelf. The data at his disposal permit Mr. Oldham to calculate the relative rates of propagation of the first and second phases of the two earthquakes, and he finds that the intervals between the arrival of the two kinds of waves were distinctly greater (after correction for difference of distance) in the case of the Colombian earthquake, with its oceanic wave-path, than in that of San Francisco, where the path was essentially continental; far greater, in fact, than is to be accounted for by errors of record or interpretation. The obvious explanation is that the constitution of the Earth under the ocean is different from that under a continent, and that the ocean basins are not merely irregularities of the surface, but intimately bound up with the constitution of the Earth itself. The Japanese records of the San Francisco earthquake also seem to indicate that the material under the Pacific transmits the second-phase waves at a slower rate, as compared with the first-phase waves, than the material under the continents. Mr. Oldham finds, further, that when the waves pass at a greater depth below the surface than about a quarter of the radius, the difference in the rate of propagation of the two kinds tends to diminish, and he therefore supposes that the differences in the matter beneath the continents and oceans do not extend inwards beyond about that proportion of the radius. He allows, however, that further data are required before these conclusions can be positively accepted.

The Curves of Rivers.—Sir Oliver Lodge, in a letter to *Nature* (November 7, 1907), calls attention to "a curious obsession as to matter of fact" with regard to the relative velocity of current on the inner and outer sides of the curves of a winding river. According to him, more than one author, "obfuscated by an erroneous theory," has been mistaken in describing the flow as being more rapid on the outer side of the curve, and in attributing the well-known scouring action of the stream on the concave bank to this "imaginary more rapid flow." He further states as a fact "that the flow is most rapid on the inner or sediment-depositing side of the bend," and quotes in support of this statement some observations by Prof. James Thomson which were laid before the British Association at Glasgow in 1876. Prof. Thomson's explanation, according to Sir Oliver Lodge, was virtually as follows: "The rapid flow on the inner and strongly curved side

of the bend piles up the water on the outer side by centrifugal force, so that near the concave bank it is nearly stationary, but elevated; its energy there is potential, not kinetic. Now, if the rapidity of flow were uniform from top to bottom, the slope would be in equilibrium; but owing to the retardation of the bend the flow near the bottom is slower, and there is not nearly so much centrifugal force exerted down below. Wherefore the piled-up water is continually returning from upper to lower level, that is from the concave to the convex bank, as an undercurrent, almost at right angles to the main stream, bringing with it, by its undertow, silt and solid matter, which it deposits near the inner side of the bend, thus constantly increasing its own sinuosity in the well-known way. The stream itself, combining a progressive with a lateral circulating motion, may be said to *screw* itself like a corkscrew round the bend; and it is the lateral circulation which shifts the bed." Reference, however, should be made to the original paper by Prof. Thomson in *Proc. Roy. Soc.*, vol. **25**, p. 5, the following passage in which gives his explanation of the transportation of silt from the outer to the inner side of the curve: "But the layer of water along the bottom, being by friction much retarded, has much less centrifugal force in any bar of its particles extending across the river; and consequently it will flow sidewise along the bottom towards the inner bank, and will—part of it at least—rise up between the stream-line and the inner bank, and will protect the bank from the rapid scour of that stream-line and of other adjacent parts of the rapidly flowing current; and as the sand and mud in motion at the bottom are carried in that bottom layer, they will be in some degree brought in to that inner bank, and may have a tendency to be deposited there." The rising-up of the bottom-water between the stream-line and the river-bank is an important point, and suggests that the statement that the flow is more rapid on the inner side of the bend requires some qualification. There should be no difficulty in determining the relative surface-velocity on the two sides of the curve by actual observation. An important part of the work which is being carried out in connection with the Rivers Investigation consists in determining accurately, by floats, the surface-velocity of the current on both sides and in the centre of the rivers along a measured length of channel. For obvious reasons, the observations have been made where the channel is straightest and most uniform in depth and breadth, and they are therefore useless for this particular purpose. Similar experiments, however, could be carried out at a series of bends in any river, and, further, a form of float could be devised with an object suspended from it which might illustrate the corkscrew course of the water.

Natural Bridges.—Prof. Früh, of Zürich, gives an exhaustive analysis of the varied forms of "natural bridge" in a paper entitled "Ueber Naturbrücken und verwandte Formen, mit spezieller Berücksichtigung der Schweiz" (St. Gallen, 1906). The term is used by him in its widest sense, to mean a path, passage, road, tunnel, *i.e.* any means of transit across a natural obstacle to traffic. Prof. Früh divides the subject into three main sections:—A.—Bridges conditioned by unstable tracts of land, *e.g.* a marsh, across which a stream constitutes a natural highway or bridge. B.—(i.) Means of overcoming obstacles such as hollows, rifts, ravines, etc., when these are unbridged, *e.g.* (*a*) Hollows which can be cleared at a leap, being narrow either at the surface or below, at an accessible depth, such as the French *pas*, for example, the Pas de l'Ase in the Causse Noire, also the countless dykes of Holland; (*b*) broad ravines, with accessible floors, over which moderate-sized streams flow, which streams can be crossed by a series of leaps *viâ* rock masses lying in the beds, for example, the Sihlsprung between Menzingen and Hirzel, blocked by nagelfluh. Comparable with this form, though on a far larger scale, is Adam's Bridge, between India and

Ceylon. (ii.) The various natural bridgings over of hollows, rifts, ravines, etc.: (*a*) When a spur of land projects, hanging, over the hollow; (*b*) when the bottom of the ravine itself is such as to form a way instead of the top; (*c*) when fallen masses bridge over crevasses or eroded valleys, such as snow-bridges over crevasses, heaps of volcanic *débris* across dry valleys, masses of rock and ice across high-level mountain valleys, etc.; (*d*) when partially exposed valleys which have been eroded underground are naturally spanned—many examples in the Karst districts. C.—Rock doorways, borings, perforations, etc., through sea-coast cliffs, islands, reefs, by the action of the wind, waves, etc.; for example, the Old Man of Hoy. Many subdivisions are made, and the whole is copiously illustrated by examples taken from all parts of the world, chiefly from Switzerland in section B. Four views taken from photographs and a few diagrams also illustrate section B. This short work contains a great amount of condensed information, including, at every point, valuable references, which constitute an extensive bibliography on the subject.

GENERAL.

The Death of Captain Cook.—Some attention has lately been drawn in New South Wales to a version of the death of Captain Cook obtained many years ago, during a visit to Hawaii, by Captain Charles, now a veteran of ninety years, and a member of the Legislative Council of that State. A copy of the statement, written down at the request of the Governor, Sir Harry Rawson, has been kindly sent to us by the Hon. Bruce Smith, K.C., a member of the Federal Parliament. Visiting the scene of the navigator's death in March, 1850, Captain Charles met with an old man who had been present at the catastrophe, his recollections of which he recounted to his visitor. Among other points, he stated that Cook stumbled in a drain or crack in the flat lava-rock, and, falling, was thereupon killed: also that the reason for the sudden hostility of the natives was the desecration of their sacred ground and altar by the white men, who landed spars at the spot, took up their residence at the temple, and spread sails over the altar. While any tradition regarding this tragic event deserves impartial consideration, it cannot be said that this particular story is such as to merit acceptance in preference to the far better authenticated versions which we previously possessed. Like the account recorded in the *Athenæum* for August 16, 1884 (to which our attention has been called by Prof. J. K. Laughton, and which has some features in common with that given to Captain Charles), it rests merely on native recollections or traditions of the event current many years after, to set against which we have not only the narratives of actual participators in the occurrences, carefully recorded at the time by Cook's officers, but the much earlier native versions given to European visitors. Thus Ellis, in his 'Narrative of a Tour through Hawaii,' published in 1876 (pp. 100 *et seq.*), gives the results of his careful inquiries addressed to natives acquainted with the circumstances, and these confirm in a most satisfactory way the general accuracy of the version recorded by Captain King, while giving no hint of any breach of tabu as responsible for the hostilities. That such was their cause is rendered the less probable by the quasi-deification received by Cook, and the fact that tabu had constantly been imposed by the priests *in his favour*. There is, besides, nothing mysterious or inexplicable in the generally accepted version which might dispose us to question its truth, if we remember the sudden changes of mood to which uncivilized races are notoriously liable, and the friction so often induced, in their first intercourse with white men, by their inability to resist the temptation offered by the sight of objects—particularly iron—representing untold wealth in their eyes. For the theft of the boat, which was the immediate cause of the trouble, was, according to Ellis's informants, due to the attraction presented by

the iron nails used in its construction. The marvel is, not that hostilities should have broken out on this occasion, but that Cook should have passed unscathed through so many previous situations fraught with risk of a similar catastrophe.

OBITUARY.

Mr. Howard Saunders.

THE loss sustained by science, and especially by the science of ornithology, in the death of Mr. Howard Saunders, at the age of seventy-two years, will be long and widely felt. His exceptionally high position, and his valuable services from that point of view, have been ably recorded elsewhere. But Mr. Howard Saunders was a many-sided man, and this Society has to mourn the loss of a warm friend to geography, who had prepared himself for a seat on our Council by extensive travel. The present writer first made his acquaintance forty-eight years ago, when he was in a mercantile house at Lima. He was then a very young man, taking an intelligent interest in geographical research and in the distribution of the avi-fauna of Peru. In few places are the gulls and terns so closely gathered together as in Callao bay and round the Chincha islands. Their study was fascinating, and it is probable that young Howard Saunders first conceived a predilection for this branch of ornithology during his residence at Lima. On leaving Peru he undertook a remarkable journey across the Andes and down the Amazons to Pará, a much more difficult undertaking in those days than it is now. While diligently continuing his ornithological studies after his return, he paid several visits to Spain in pursuance of his favourite branch of science, where his knowledge of the language enabled him to carry out his researches with valuable results. In 1882 Mr. Howard Saunders took over from Prof. Newton the editorship of the fourth edition of 'Yarrell's British Birds,' and seven years afterwards he brought out his own excellent work, the 'Manual of British Birds.' A second edition was called for, and was published in 1899, which is still a standard book of reference. It was followed by his great work for the British Museum on 'The Gulls of the World.'

Mr. Howard Saunders was elected a Councillor of the Royal Geographical Society in 1893, and, except for one short interval, he continued to serve on the Council to the day of his death. It may safely be said that the Council has never had a more conscientious attendant at its meetings and at those of its Committees. He scarcely ever missed, nor were his attendances confined to mere discussion. His advice was always weighty, his conduct loyal and sensible, especially during the fitting out of the Antarctic Expedition. But, as has been said, he did not confine his support to words. He was always ready to help actively, and, with other work, he undertook the ornithological section of the 'Antarctic Manual.'

Mr. Howard Saunders was the first authority in Europe on gulls and terns, and this gave his section of the Manual a very special value. It showed his intimate knowledge of the narratives of every voyage that ever crossed or approached the Antarctic Circle, and is an interesting and pleasant essay for the general reader, touching as it does, with special knowledge, on such episodes as the shooting of the albatross in Shelvocke's voyage, which supplied Coleridge with the idea elaborated in the "Ancient Mariner." The essay is accompanied by a descriptive list of the Antarctic birds. The task was no easy one, as is shown by the somewhat difficult investigation Mr. Howard Saunders had to make with reference to a statement that one of the "sheathbills" had once been shot within the Antarctic Circle. Mr.

Howard Saunders was remarkable for the thoroughness and accuracy with which he did everything he undertook.

The loss of this distinguished naturalist will be very widely felt. Amiable and kind-hearted, he was always ready to assist others, and he was valued as an able and diligent colleague, as well as an agreeable acquaintance and a good and most reliable friend. The Council of this Society will feel, with me, that mine is the language of truth.

C. R. M.

Prof. Angelo Heilprin.

We regret to announce the death of Prof. Angelo Heilprin, the founder and first president of the Geographical Society of Philadelphia, and a Fellow of our own Society since 1896. Though only fifty-four years of age, and though much of his earlier work was concerned with other branches of science, Prof. Heilprin had long played a prominent part in encouraging the study of geography on scientific lines in the United States. Born at Satoralija-Ujhely in 1853, the son of one of the leaders in the Polish struggle for independence, who shortly afterwards was driven into exile, he was educated in the United States, taking a special interest in the study of geology. After further studies in London, Geneva, and Vienna, he returned to America, and in 1880 was appointed professor of invertebrate palæontology and geology at the Academy of Natural Sciences in Philadelphia. This and other positions he occupied at Philadelphia till, twenty years later, he accepted the offer of a chair of geography at Yale University. An ardent advocate of field-work, which he prosecuted in numerous summer excursions, including the Peary auxiliary expedition of 1892, Prof. Heilprin took a special interest in the problems of North, Central, and South American geography, and in questions relating to the Arctic regions. The results of his investigations and studies appear in numerous writings, that which first brought him to the notice of geographers being his handy treatise on the distribution of animals, which appeared in 1887 in the 'International Scientific Series.' Two years later he published an important monograph on the 'Physical History and Zoology of the Bermuda Islands,' after the appearance of which he undertook an expedition, on behalf of the Philadelphia Academy of Natural Sciences, to the great volcanoes of Mexico, the heights of which he for the first time determined by accurate barometric measurements. His later work included researches at the sites of the West Indian volcanic catastrophes of 1902, on which he published various memoirs, as well as a book entitled 'Mont Pelée and the Tragedy of Martinique' (1903). On a later visit, he paid special attention to the remarkable pillar or obelisk left standing as a result of the later phases of the Pelée eruption. Lastly, he has left a monument to his great industry in the latest edition of 'Lippincott's Gazetteer,' in the preparation of which his brother also took part.

Mr. J. F. Mann.

The death at Sydney, New South Wales, on September 7, of Mr. John Frederick Mann removes the last survivor of the expeditions undertaken by the ill-fated explorer, Dr. Ludwig Leichhardt, into the interior of Australia in the forties of last century. Mr. Mann was a son of General Cornelius Mann, R.E., who sometime held command at Gibraltar, and was intended for a military career. But after passing through Sandhurst he first joined the Trigonometrical Survey of Great Britain; and then, in 1841, when twenty-two years of age, went out to New South Wales, being drawn to a colonial career by the example of his friend

the late Sir George Grey. The long interval which elapsed without news of Dr. Leichhardt on that explorer's journey across North-Eastern Australia from Brisbane to Port Essington in 1844–45, led Mr. Mann to make preparations for a relief expedition; and when the news of Dr. Leichhardt's safety rendered that project unnecessary, he offered his services to the explorer, and accompanied him on his next expedition, when an unsuccessful attempt was made to cross the continent from east to west. Remaining behind when Dr. Leichhardt set out on his last journey, Mr. Mann joined the Survey Department of New South Wales in 1848, and maintained his connection with that branch of the public service till 1875, taking an active part in exploring and mapping the colony. For several years before his death he rendered further service to the cause of geography in New South Wales as honorary secretary of the branch in that state of the Royal Geographical Society of Australasia.

CORRESPONDENCE.

On the Influence of Ice-melting upon Oceanic Circulation.

I feel bound to reply in a few words to the critical remarks which Captain T. H. Tizard has done me the honour to make regarding certain statements in my paper on Oceanic Circulation (*Geogr. Journ.*, **30**, No. 3, p. 273).

The paper contains some conclusions drawn from recently discovered analytical facts which Captain Tizard considers more appropriate to the Chemical than to the Geographical Society. I do not think, however, that the members of the Chemical Society would have taken much interest in the fact that there is a deficiency amounting to $\frac{26}{1000000}$ of halogens relatively to other saline components in the bottom water of the Norwegian sea, etc. Such details are of interest only to those sciences of which they can elucidate some pending problem.

In 1899, a number of hydrographers, with Sir John Murray in the chair, assembled in Stockholm to lay down the programme of an international investigation of the sea. Part of this programme was the determination of the physical and chemical properties of sea-water, which has resulted in the present standardization of the methods and the constants of hydrographic science. Side by side with this labour there has been a movement in a seemingly opposite direction, viz. to discover small irregularities and local exceptions from the average numbers in order to trace the origin of sea-waters by certain marks in their chemical composition, planktonal and gaseous contents, etc. The scientists engaged in this task—*quorum pars minima fui*—have not been so successful in their endeavours to individualize, as their colleagues in their efforts to standardize the properties of ocean water. Now and then, however, there appears, often very unexpectedly to the observer, some new fact which acts like a kind of *Leitmotiv*, directing our attention to some hidden agent at work in the depths of the sea.

In my two last papers in this *Journal* I have called attention to such an agent, viz. the ice-melting in the ocean, which, according to my view, has a preponderating influence upon the circulation of its waters. The present theory ascribes the circulation to atmospheric influence of thermic and mechanical kind. The principles of the ruling theory are aptly summarized in Nansen's words—*

"According to my view, the chief cause of the circulation of the sea is the combined effect of the cooling of the water and of the winds. I do not believe that

* *Geogr. Journ.*, September, 1907, p. 297.

ice-melting has much influence in this respect; I think it has practically no effect upon the cooling of the sea, because the ice is formed and melts in the same sea, and the heat which is disengaged the moment the ice is formed is again engaged by the melting process, so the direct cooling effect of these processes is *nil*."

And further—

"The circulation of the sea has no resemblance whatever to rivers; it means the continuous movement of the whole water-masses from the surface to the bottom and over the whole area of the sea."

This is quite in accordance with the theory propounded thirty-five years ago by Zöppritz, which, strange to say, still rules the minds of the oceanographers of the present day. The ocean borrows its store of heat, its temperature, and its energy of motion from the atmosphere; the motion imparted by the winds to the waves is propagated from the surface to the bottom layer until the entire mass of water is in motion, etc.

I have ventured, on the contrary, to suggest the idea that the ocean on the whole does not take its motive power second-hand from the atmosphere, but directly by radiation from the sun, and that it contains in itself sources of energy and fields of forces superior to those existing in the air. I hold that there is in activity in the ocean a thermodynamic cycle of transformations of solar energy between the tropical and the Arctic and Antarctic regions, which has its upper limit of temperature at T = 300° (27° C.), and its lower limit at the point of equilibrium between ice and sea-water at T = 271° (–1°·9 C.), and that the mechanic effect of that cycle approaches the theoretical limit as closely as that of the best engine ever constructed, and even leaves a surplus of *work* sufficient to rule part of the movements of the undermost layer of the atmosphere and the changes in the climate and the weather of the countries bordering upon the ocean. I have compared this cycle to that of an engine of which the boiler is placed in the tropical and the cylinders in the Arctic and Antarctic regions of the ocean, where the mighty ice-caps which cover the polar seas form the condensers. I have also tried to explain why the transformation of heat energy into work—as every other transformation in nature—takes place at the *surfaces of contact* between the air and the water in the warmer and between ice and water in the colder regions of the sea.

I am aware that this must sound paradoxical, and I regret not being able, in papers written for this *Journal*, to hold forth side views and show up points of transition between my views and those of other hydrographers.

I am also aware that this will remind many of us of the controversy between the upholders of the physical and the mechanical theory of oceanic circulation debated so eagerly forty years ago. A scientific debate must come to a close when all available arguments are used up. Such was the case then. I think, however, that we have gained new ground to stand upon since Croll's and Carpenter's time, and that the old question can and must be taken up again. The theory of Zöppritz, or the "wind-theory" as it is usually called, has outlived itself. The celebrated papers of Zöppritz in the *Annalen* will retain their value as specimens of hydrodynamics, but of the great structure of consequences which Zöppritz and others had deduced from that theory concerning oceanic circulation there is not left one stone upon another, for the following reason. Zöppritz regarded the waters of the ocean as a homogeneous fluid, while experience shows that there exists a kind of stratification in the ocean, lighter water-layers being superposed upon waters of higher density. In some measure this holds also for the atmosphere. Two important consequences arise from this.

First, particles which belong to one layer have a tendency to remain in the same layer. Consequently the motions imparted to the uppermost water-layer by the

winds will not be propagated to the next. The same will hold for convection currents caused by the cooling influence of the atmosphere upon the surface waters.

Of course, motion in one layer may induce motion in an adjacent layer by impact or by friction, but such motions usually result in undulatory motion (such as submarine waves and seiches, water whirls, etc.), and are soon quenched by the reaction from the second layer. A particle belonging to the upper layer will not transfer its motion to a particle in the next (because it cannot penetrate into that layer), but to a number of particles or, so to speak, to the entire mass of water contained in that layer. If the ocean consisted of a homogeneous fluid, as Zöppritz imagined, the winds would cause a circulation of the same kind as that Sir John Murray found to exist in certain Scottish lakes, *i.e.* it would gradually bring up the bottom waters to the surface and *vice versâ* by updrift. Under the circumstances really existing in the ocean, the strongest wind continually blowing would never bring a single particle of the deepest water-layers into contact with the atmosphere, or sink a particle of surface water to the bottom, because the circulation caused by the wind would be limited to a relatively thin upper stratum. We have found that in the Baltic, which furnishes a typical example of stratification, movements of the surface waters cause great dislocations in the undermost layer, without, however, being able to call forth a circulation in *the vertical direction* between the different strata. The only agent which can do this is the melting of ice in sea-water. Or, as I have expressed it, "The cool and dense sea-water of more than 1·028 specific weight which descends to the depth of the sea in the regions where the ice-melting process takes place breaks through all intermediary water-layers, and, by aërating the bottom water, creates the conditions necessary for organic life in the abysses of the ocean." This is the reason why I have propounded the ice-melting theory.

Secondly, every medium in which stratification takes place under the influence of gravitation is in a state of equilibrium, and is consequently a conservative system which reacts against disturbances. The very faint tendency to stratification * which exists in the atmosphere is sufficient to establish a certain stability in the *vertical* movement of the air. Over every heated area of the Earth the air ascends, expanding its volume *adiabatically*. The influence of earth-rotation will convert this ascending motion into a gyratory motion, *i.e.* into a cyclone, in case the ascending column possesses a sufficient store of heat energy to break through the surrounding strata; if not, *i.e.* if the buoyancy of the air has been reduced below that of the surrounding medium, the cyclone is quenched in its birth.

The stratification is far more marked in the hydrosphere than in the atmosphere, and the conservative tendency is consequently stronger, so strong, indeed, that it compensates the influence of every wind which does not blow continually in the same direction. Sandström † has shown, from actual observations at Bornö, in the Gullmarfjord, that every time a gale ceases to blow, the reactive power of the ocean sets up a counteraction which tends to restore the *status quo ante*. Thereby the pivot of the wind theory or the *theory of the cumulative effect of the wind upon the waters is withdrawn*. The local effect may be as great as possible, the total effect will be *nil*, unless the wind, as before said, blows continually from one direction. In such case its effect will be to impart a gyratory motion to the waters of the adjoining layers with a rapidly increasing deviation from the

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* I suppose that this tendency is due to the inhomogeneity of the atmosphere (*vide* Dalton's theory of the co-existence of different kinds of atmospheres: (CO_2, N_2, H_2O, etc.).

† Sandström has published his discovery in an excellent little paper in the 'Publications de Circonstance de l'exploration Internationale de la Mer,' to which I wish herewith to direct the attention of hydrographers.

original direction on account of the Earth's rotation. W. Ekman has shown that actual wind currents can only exist at the surface of the open sea and do not extend to great depths, for as soon as the wind looses its hold upon the water-particles their motion will be ruled by the influence of the Earth's rotation.

Concerning the other points of divergence between Captain Tizard and myself I can be brief. I think that I can maintain the statement that the bottom water of the eastern side of the Barents sea, which has $-1{\cdot}7$ up to $-2°$ C. temperature, is, as far as we know at present, the coldest and saltest in existence. The extremely low temperature found by Ross (1818) in Baffin bay, and others, must be ascribed to the imperfect instruments of that time.

The ice-melting theory does not imply of necessity that the bottom temperature must be the same in all parts of the ocean. Ridges and submarine banks intercept the flow of the coldest bottom water and skim off waters of a somewhat higher temperature and less density according to the position and the elevation of the ridge, as, *e.g.*, the Iceland Færoe and Wyville-Thomson bank, the Valdivia ridge, etc. We know too little of the conditions of the deep waters of the North Atlantic to decide whether it has its chief origin in the Arctic or Antarctic sea. I must, however, call attention to the fact that the discharge of cold bottom water from the Norwegian sea over the crest of the Iceland-Færoe and Wyville-Thomson ridge (see Fig. 3 on p. 280), and also the masses of Gulf Stream water which sinks to the bottom of the Atlantic off Newfoundland cooled and diluted by the ice-melting, must meet the cold bottom current from the southern hemisphere at some place which cannot well be northlier than the southern edge of the Newfoundland banks, but probably is situated nearer to the equator, where the rising of the isotherms indicates an accumulation of cold bottom water from below. I do not think that this cold water rises to the surface under the equator, although there certainly is a tendency in the water to ascend. In my original paper * I have discussed this question, with the result that the place where the cold deep water rises to the surface is not the equatorial, but probably the central tropical parts of the ocean, a result which, although it may be contrary to the ruling opinion among hydrographers, is nevertheless borne out by the dynamic diagram of forces (solenoid-diagram after Bjerknes) delineated on Plate II. of the paper in question. We know too little of the hydrography of the Gulf Stream and the "cold wall" on the American side of the Atlantic to be able to trace with security the origin of its waters.

This brings my thoughts to bear on the last critical remark of Captain Tizard concerning my statement that, the Atlantic is hydrographically a "*mare incognitum*," an expression which, of course, is meant to be taken *cum grano salis*.

The fact is that, although we know a great deal of the topography of the Atlantic basin and something of the statics of its hydrographic conditions, we still lack the elementary data necessary to account for the circulation of its waters. What do we know of the *vis movendi* of the great Atlantic warm-water current called Gulf Stream? What do we know of its velocity, its variations, its periodicity? Has anybody yet executed a cross-section of serial soundings of the Labrador Current? or traced the course of the cold water which vanishes from the surface off Newfoundland?

A multitude of problems of the highest importance to mankind are waiting for their solution by a systematic survey of the Atlantic. The leaders of the great expeditions with the *Challenger*, the National, the *Valdivia*, and others, have shown

* "Ueber die Wahrscheinlichkeit von periodischen und unperiodischen Schwankungen in dem Atlantischen Strom" ('Svenska Hydrografisk Biologiska Kommissionens Skrifter.' Göteborg and Berlin: J. Springers Verlag).

the way how to attack those problems, but they have also shown the insufficiency of isolated reconnoitring expeditions to master the paramount question—the oceanic circulation. Only a systematic survey can do that. The results obtained by the scientists of the said expeditions have furnished the base for a future research, *severunt arbores quæ alteri sæculo prosint.* May we hope that the century which shall complete their work will be ours, not the next or next-next!

O. Pettersson.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1907-1908.

First Meeting, November 11, 1907.—The Right Hon. Sir George T. Goldie, K.C.M.G., D.C.L., LL.D., F.R.S., President, in the Chair.

The President said—

Geography in the Civil Service.

I do not propose to revive the former practice of giving at this opening meeting of our session an account of the geographical events during our four months' recess; it is more convenient, as I think I explained to you last year, that these should be dealt with at the annual meeting when the President has to deliver his address, so as to make the geographical history of the year complete in itself. There is one subject, however, which I might mention in a few words—I shall have to reserve any fuller comments for my annual address in May—and that is, the Civil Service examinations of this country. I dare say many of you may remember that in the summer of last year there was a retrograde step taken in striking geography out of the examinations for the Foreign Office. We never complained, nor do I now complain, of the action taken in that respect; it was simply bringing the examinations for the Foreign Office into line with the examinations of the rest of the Civil Service of this country, and from an organizing point of view it appeared sound, but so far as geography was concerned it was a retrograde step. However, we thought we would take advantage of that to make a forward move. It is not quite twelve months since I had the pleasure of firing the first shot at an address which I gave to the Scottish Geographical Society in Edinburgh. I need not tell you the story of the last twelve months; it is rather interesting, and I shall have to tell it at the Anniversary Meeting in May. The result has been, as you may have seen in the papers a few days ago, that geography henceforth will be one of the subjects of examination for all the Civil Service examinations of this country. I will reserve my comments for a future time.

The late Mr. Howard Saunders.

I will briefly refer to the regretted death of Mr. Howard Saunders, who, as many of you know, had been a member of our Council almost continuously since 1893. Although ornithology was his special science, he was also a most distinguished geographer, and he gave unremitting attention to the geographical work in our Society. I will not say any more about his regretted death, because Sir Clements Markham has written an obituary notice of him, which will appear in the December number of the *Journal*, where you will read the interesting career of a most distinguished ornithologist and geographer.

The paper read was :—

"The Great Douglas Glacier of New Zealand and its Neighbourhood." By J. Mackintosh Bell, Director-General of the New Zealand Survey.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are as a rule written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendes.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k.k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps. **Whymper.**
A Guide to Zermatt and the Matterhorn. By Edward Whymper. Eleventh edit. (pp. xiv. and 224).
Chamonix and the range of Mont Blanc. By the same. Twelfth edit. (pp. xiv. and 206). London: John Murray, 1907. Size 7½ × 5. *Maps and Illustrations. Price 3s. each. Two copies, presented by the Author and Publishers.*

Alps. **Penck and Brückner.**
Die Alpen in Eiszeitalter. Von Dr. Albrecht Penck und Dr. Eduard Brückner. Lieferung 8. Liepzig: Chr. Herm. Tauchnitz, [*not dated*]. Size 10½ × 7½, pp. 785-896. *Maps, Sections, and Illustrations. Price 5m. Presented by the Publisher.*

Alps. **Rey.**
The Matterhorn. By Guido Rey; with an Introduction by Edmondo de Amicis. Translated from the Italian by J. G. C. Eaton. London: T. Fisher Unwin, 1907. Size 10½ × 7, pp. 336. *Illustrations. Price 21s. net. Presented by the Publisher.*
See notice of the Italian edition in vol. **23**, p. 506.

Alps—Meteorology. *Meteorologische Z.* **24** (1907): 193-200. **Prohaska.**
Die Hagelfälle des 6. Juli 1905 in den Ostalpen. Von Prof. Karl Prohaska. *With Maps.*

Alps—Monte Rosa. **Coolidge.**
Il Monte Rosa al XVIII. secolo. Del Rev. W. A. B. Coolidge. (Estratto dalla *Rivista Mensile del C. A. I.*, vol. **26**, No. 4.) Torino, 1907. Size 9½ × 6, pp. 6. *Illustrations. Presented by the Author.*

Austria—Geology. *Deutsche Rundschau G.* **29** (1907): 289-297. **Götzinger.**
Ueber die geologische Bedeutung der Granitklippe mit dem L. v. Buchdenkmal im Pechgraben bei Weyr in Oberösterreich. Von Dr. Gustav Götzinger. *With Illustrations.*
Based in part on a previous paper by G. Geyer (*Verhandl. der K.K. Geol. Reichsanstalt*, 1904), in which conclusions were drawn as to the geological history of this region.

Austria—Istria. *Globus* **91** (1907) : 249–254. **Moser.**
Ein Ausflug nach der Sandinsel Sansego. Von Prof. Dr. L. Karl Moser. *With Illustrations.*

Austria—Karst. *Globus* **91** (1907) : 297–303. **Mühlhofer.**
Die Erforschung des Magdalenenschachtes. Ein Beitrag zur Studium der Karstphänomene. Von Leutnant Franz Mühlhofer. *With Plan, Section, and Illustrations.*

Austria—Meteorology. ———
Jahrbücher der K. K. Zentral-Austalt für Meteorologie und Geodynamik. Jahrgang 1905. Neue Folge, xlii. Band. Wien, 1907. Size 12 × 9, pp. xxxiv. [and 266].

Austria—Moravia. *M.k.k.G. Ges. Wien* **50** (1907) : 5–27. **Trampler.**
Die mährischen Karsttäler. Von R. Trampler.

Austria—Salzburg. *Globus* **91** (1907) : 373–378. **Jaeger.**
Das Gesteiner Tal. Von Julius Jaeger. *Also separate copy.*

Baltic. *G. Anzeiger* **8** (1907) : 121–129. **Schmidt and Spethmann.**
Die Ostsee. I. Entstehungsgeschichte der Ostsee. Von Dr. W. Schmidt. II. Die Genetik des südwestlichen Baltikums seit der Eiszeit. Von Hans Spethmann. *With Maps.*

Bulgaria. ———
Bulgaria of to-day. Official edition of the Bulgarian Ministry of Commerce and Agriculture. London, 1907. Size 8½ × 5½, pp. xvi. and 300. *Maps, Diagrams, and Illustrations. Presented by the Balkan States Exhibition.*

A useful summary, dealing with the people, administration, commerce, etc.

Central Europe—Lake of Constance. **Halbfass.**
Deutsche Rundschau G. **29** (1907) : 337–347.
Die Verkehrsgeschichte eines Binnensees. Von Wilhelm Halbfass. *With Illustration.*

Central Europe—Phytogeography. *Abrégé B.S. Hongroise G.* **35** (1907) : 17–30. **Szabó.**
Eine pflanzengeographische Skizze der Sudeten, mit besonderer Berücksichtigung der südalpinen und alpinen Flora des Riesengebirges. Von Dr. Z. Szabó. (*Földrajzi Közlemények* **35** (1907) : 47–59, 96–115. *With Map and Illustrations.*)

Europe—Health Resorts. **Linn.**
The Health Resorts of Europe: a medical and popular guide to the mineral springs, climatic mountain and seaside health resorts, hydropathics, and sanatoria of Europe. By Thomas Linn. Edited by A. C. Glynn Grylls. 15th edit. London: The Health Resorts Bureau, 1907. Size 7 × 4½, pp. 284. *Price 2s. 6d. net. Presented by the Publishers.*

Europe—Zoogeography. **Lobley.**
The History of the Spread of the European Fauna. By Prof. J. Logan Lobley. London, [1907]. Size 8½ × 5½, pp. 18. *Presented by the Author.*

France—Champagne. **Chantriot.**
Émile Chantriot. La Champagne : étude de géographie régionale. Paris : Berger-Levrault & Cie., 1906. Size 10 × 6½, pp. xxiv. and 316. *Maps, Illustrations, and Diagrams. Price 8 fr.*

France—Jura. *Spelunca* **7** (1907) : No. 47, pp. 28. **Fournier.**
Recherches spéléologiques dans la chaine du Jura. Par E. Fournier. 7e Campagne, 1904–05. *With Sections.*

France—Paris. **Baedeker.**
Paris and environs, with routes from London to Paris. Handbook for travellers by Karl Baedeker. 16th edit. London: Dulau & Co., 1907. Size 6½ × 4½, pp. liv., 470, and 48. *Plans, etc. Price 6s. Presented by the Publishers.*

France—Pyrenees. *B.S.G. Com. Bordeaux* **33** (1907) : 140–147. **Descombes.**
L'aménagement des montagnes dans les Pyrenées Orientales. Par Paul Descombes.

Germany—Bavaria. **Breu.**
Der Kochel-See. Limnologische Studie. Ein Beitrag zur Bayrischen Landeskunde von Georg Breu. (Berichte des naturwissenschaftlichen Vereines zu Regensburg. X. Heft, 1903 und 1904, pp. 121–222.) Regensburg, 1905. Size 9 × 6. *Maps, Illustrations and Diagrams. Price 8s. 6d.*

Germany—Brandenburg. *Naturw. Wochenschrift* **22** (1907): 321–330. **Wahnschaffe.**
Die Seenrinne des Grunewalds und ihre Moore. Von Prof. Dr. F. Wahnschaffe. *With Sketch-map and Illustrations.*

Noticed in the September number (p. 330).

Holland—Glaciation. *Ts. K. Nederlandsch Aard. Genoots.* **24** (1907): 406–448. **Lorié.**
Het interglacialisme in Nederland. (De voorgestelde eenheid van het Ijstijdvak, iii.) Door J. Lorié.

Iceland. **Herrmann.**
Island in Vergangenheit und Gegenwart. Reise-Erinnerungen von Paul Herrmann. 2 vols. Leipzig: W. Engelmann, 1907. Size 10 × 7, pp. (vol. 1) xii. and 376; (vol. 2) vi. and 316. *Map and Illustrations. Price 15m. Presented by the Publisher.*

The first volume is historical and descriptive, the second gives an account of the auhor's travels; but even the first is to a large extent interwoven with personal observations.

Italy—Capri. **Lorenzo.**
Atti R.A. Lincei, Rendiconti, Ser. V., **16** (1907): 1 Sem., 853–857.
L'isola di Capri. Di Giuseppe de Lorenzo. *With Sections.*

Italy—Climatology. **Millosevich.**
Atti R.A. Lincei, Rendiconti, Ser. V., **16** (1907): 1 Sem., 615–625.
Dell' influenza della catena degli Appennini sulla distribuzione della pioggia nell' Italia centrale. Del dott. Filippo Eredia.

Italy—Geology. *Petermanns M., Ergänzungsheft* 156 (1907): pp. iv. and 202. **Stefani.**
Die Phlegräischen Felder bei Neapel. Von Prof. Dr. Carlo de Stefani. *Map and Illustrations.*

Italy—Lagoon of Venice. **Magrini and Others.**
Ricerche lagunari, per cura di G. P. Magrini, L. de Marchi, T. Gnesotto. N. 4-5. Programma di ricerche biologiche lagunari. Sulle attinie della laguna di Venezia (pp. 40). No. 6. Le attuali conoscenze sulla flora lagunare ed i problemi che ad essa si collegano. Di A. Béguinot (pp. 20). No. 7. Prima relazione annuale (pp. 16, *Map*). Venezia, 1907. Size 10 × 7.

The map (in No. 7) shows the lines of levelling so far carried out, and the locations of tide-gauges (cf. *Journal,* vol. **27**, p. 298).

Spain—Cordova. **Calvert and Gallichan.**
Cordova: a city of the Moors. By Albert T. Calvert and Walter M. Gallichan. London: J. Lane, 1907. Size 7½ × 5, pp. xvi. and 108. *Plans and Illustrations. Price 3s. 6d. net. Presented by the Publisher.*

United Kingdom—Antiquities. **Hubbard.**
Neolithic dew-ponds and cattle-ways. By Arthur John Hubbard and George Hubbard. 2nd edit. London: Longmans & Co., 1907. Size 10 × 7, pp. xxiv. and 116. *Plans and Illustrations. Price 4s. 6d. net. Presented by the Publishers.*

The first edition was reviewed in vol. **26**, p. 443. This contains a considerable amount of new material, a number of additional antiquities being discussed and illustrated.

United Kingdom—Devon. **Jukes-Browne.**
The hills and valleys of Torquay: a study in valley-development and an explanation of local scenery. By A. J. Jukes-Browne. Torquay, 1907. Size 7½ × 5, pp. viii. and 104. *Maps, Sections, and Illustrations. Price 3s. 6d. Presented by the Author.* [See Review, vol. **30**, p. 548.]

United Kingdom—London. **Barber and others.**
The port of London and the Thames barrage. A series of expert studies and reports on the conditions prevailing in the tidal river and estuary of the Thames; dealing especially with its geological, engineering, navigation, sanitary, trading and commercial aspects, and the effects upon these of various proposals which have been made for improvement of the tidal river as the port of London Comprising independent studies and investigations by T. W. Barber, and by C. J. Dibdin, E. T. Hennell, Clayton Beadle, and D. Urquhart. London: Swan, Sonnenschein, & Co., 1907. Size 10½ × 7½, pp. 194. *Maps, Plans, and Illustrations. Price 12s. 6d. net. Presented by the Publishers.*

United Kingdom—London. **Beck.**

Memorials to serve for a history of the parish of St. Mary, Rotherhithe, in the County of Surrey and in the Administrative County of London. By Edward Josselyn Beck. With a chapter on the geology of the Thames valley and of Rotherhithe, by the Rev. T. G. Bonney. Cambridge: University Press, 1907. Size 9 × 5½, pp. xvi. and 270. *Plans and Illustrations. Price* 10*s. net. Presented by the Publishers.*

Rotherhithe, or Redriff, as it is even now known in popular parlance, took a fairly important part in early oversea enterprise, and some of the facts here recorded have a bearing on this side of its history, to which, however, less attention is given than could have been wished.

United Kingdom—Scotland. **Geikie and others.**

Memoirs of the Geological Survey of Great Britain. The geological structure of the North-West Highlands of Scotland. By Dr. B. N. Peach, Dr. J. Horne, W. Gunn, C. T. Clough, and L. W. Hinxman, with practical chapters and notes by J. J. H. Teall. Edited by Sir Archibald Geikie. Glasgow, 1907. Size 10 × 6, pp. xviii. and 668. *Map, Sections, and Illustrations. Price* 10*s.* 6*d. Presented by the Geological Survey.*

ASIA.

Central Asia. **Grum-Grjimailo.**

Travels in Western China. By G. E. Grum-Grjimailo. Vol. 3. Round the Koko-nor, across the Nan-shan, Be-shan, and along the eastern Tian-shan. [In Russian.] St. Petersburg, 1907. Size 12¼ × 9, pp. vi. and 532. *Maps and Illustrations. Presented by the Imperial Russian Geographical Society.*

Central Asia—Tian-Shan. **Keidel.**

Einige Berichtigungen zu meinen Arbeiten über den Tian-Shan. Von H. Keidel. (Separat-Abdruck aus dem Centralblatt für Mineralogie, Geologie, und Paläontologie. Jahrg. 1907, No. 9.) Stuttgart, 1907. Size 9 × 6, pp. 271–275.

Corrections to the memoir referred to in vol. **29**, p. 357, of the *Journal*, necessitated by the author's absence when the proofs were revised.

China—Shantung and Kiangsu. **Garnett.**

China. No. 1 (1907). Report by Mr. W. J. Garnett on a journey through the provinces of Shantung and Kiangsu. London, 1907. Size 13 × 8½, pp. 26. *Maps. Price* 6*d.*

China—Yangtse Provinces. **Bons d'Anty.**

B. Comité Asie Française **7** (1907): 197–207.

La mission Bons d'Anty.

Contains much information on the province of Hunan and its capital, Changsha.

Dutch East Indies. **Blink.**

Nederlandsch Oost- en West-Indië: geographisch, ethnographisch en economisch beschreven door Dr. H. Blink. Tweede Deel. Leiden: E. J. Brill, 1907. Size 10 × 7, pp. xii. and 586. *Price* 16*s.* 6*d.*

Dutch East Indies. **Serrurier.**

De Compagnie's Kamer van het Museum van het Bataviaasch Genootschap van Kunsten en Wetenschappen. (Door M. Serrurier.) Batavia, etc., 1907. Size 11½ × 9, pp. 14. *Illustrations.*

Describes the steps taken to fit up a hall with antique Eastern furniture, etc., as used in the old days of the Dutch East India Company.

India. ——

Annual report of the Board of Scientific Advice for India, 1905–6. Calcutta, 1907. Size 10 × 7, pp. vi., 172, and x. *Map.*

Contains some items of news regarding surveys, etc., outside India (cf. August number, pp. 212, 213).

India—Language. **Thimm.**

Hindustani grammar self-taught. By Captain C. A. Thimm. Second edition. London: Marlborough & Co., 1907. Size 7½ × 5, pp. 120. *Price* 2*s.* 6*d. Presented by the Publishers.*

This little book seems fairly good of its kind, though the *rationale* of Hindi idioms is not always so clearly explained as it might be. To give an instance quite at random, the phrase for "I have no knife" (to me knife [there is] not) is explained by the inadequate statement (p. 48) "verb *have* understood."

India—Language. **Wickremasinghe.**
Tamil self-taught, with English phonetic pronunciation. By M. de Zilva Wickremasinghe. London: E. Marlborough & Co., 1907. Size 7¼ × 5, pp. 96. *Price 2s. 6d. Presented by the Publishers.*

India—North-West Frontier. ——
Selections from the Records of the Government of India, Foreign Department. No. 429. Foreign Department, Serial No. 164. Administration Report of the North-West Frontier Province for 1905–6. Calcutta, 1907. Size 13 × 8½, pp. iv., vi., and 44.

India—Population. **Mayr.**
Die Britisch-Indische Bevölkerung nach den Ergebnissen der Volkszählung von 1901. Von Georg v. Mayr. (Separat-Abdruck aus dem Allgemeinen Statistischen Archiv. vii. Band, Erster Halbband.) Tübingen, 1907. Size 9 × 6, pp. 265–329.

India—Surveys. **Longe.**
Extracts from Narrative Reports of the Survey of India for the season 1904–1905. Prepared under the direction of Colonel F. B. Longe. Calcutta, 1907. Size 13½ × 8½, pp. 128. *Presented by the Surveyor-General of India.*

Indo-China—Treaty. ——
France, No. I. (1907). Despatch from His Majesty's Ambassador at Paris, transmitting the Treaty between France and Siam, signed at Bangkok, March 23, 1907. London, 1907. Size 13 × 8½, pp. 12. *Price 1½d.*

See note in vol. **29**, p. 569.

Japan—Formosa. *Rev. Coloniale* (1907): 274–288. **Kann.**
Note concernant l'industrie du camphre à Formose. Par Réginald Kann.

Japan—Formosa. *J. College Sc., Tōkyō* **22** (1906): pp. 704. **Matsumura and Hayta.**
Enumeratio plantarum in Insula Formosa sponte crescentium hucusque rite cognitarum adjectis descriptionibus et figuris specierum pro regione novarum. By J. Matsumura and B. Hayta. *With Map and Plates.*

Japan—Formosa—Earthquake. **Omori.**
B. Imp. Earthquake Investigation Com. 1 (1907): 53–69.
Preliminary note on the Formosa earthquake of March 17, 1906. By Dr. F. Omori. *With Maps and Illustrations.*

Japan—Language. **Shand.**
Japanese self-taught, with English phonetic pronunciation. Edited by W. J. S. Shand. London: E. Marlborough & Co., 1907. Size 7¼ × 5, pp. 108. *Price 2s. 6d. Presented by the Publishers.*

Likely to be useful to those desiring an elementary knowledge of Japanese.

Malay Archipelago—Sumatra. *Sitzungsb. K. Preuss. A.W.* (1907): 127–140. **Volz.**
Vorläufiger Bericht über eine Forschungsreise zur Untersuchung des Gebirgsbaues und der Vulkane von Sumatra in den Jahren 1904–1905. Von Prof. Dr. Wilhelm Volz.

Malay States—Geology. **Scrivenor.**
Federated Malay States. Geologist's report of progress, September, 1903, to January, 1907. By J. B. Scrivenor. Kuala Lumpur, 1907. Size 10 × 6, pp. x. and 44.

The latter half deals with economic geology.

Mongolia and Tibet. **Kozloff and Merezhkovski.**
Mongolia and Kham. The work of the Imperial Russian Geographical Society's Expedition, 1899–1901. Vol. **8**. Diatoms of Tibet, by K. S. Merezhkovski. [In Russian.] St. Petersburg, 1906. Size 12½ × 9, pp. 42. *Map. Presented by the Imperial Russian Geographical Society.*

Turkey. *Petermanns M.* **53** (1907): 145–153. **Schaffer.**
Grundzüge des geologischen Baues von Türkisch-Armenien und dem östlichen Anatolien. Von Dr. Franz X. Schaffer. *With Map.*

AFRICA.

Africa. **Keane.**
Stanford's Compendium of geography and travel (new issue). Africa: vol. i. North Africa. By A. H. Keane. 2nd edit. London: E. Stanford, 1907. Size 8 × 5, pp. xx. and 640. *Maps and Illustrations. Price 15s. Presented by the Publisher.*

Africa—Bantu. **Oordt.**

Cape of Good Hope. Colonial Secretary's Ministerial Division. The Origin of the Bantu. A preliminary study by J. F. Van Oordt. Cape Town, 1907. Size 9½ × 6, pp. vi. and 98.

See review in the August number (p. 202).

Africa—Communications. *R. Engineers J.* **5** (1907): 288–298. **Denison.**

Road Construction and Maintenance in Tropical Africa. By Lieut. G. W. Denison. *With Sections.*

Africa—Currencies. *M.G. Ges. Hamburg* **22** (1907): 1–34. **Kürchhoff.**

Die Geldverhältnisse im heutigen Afrika in ihrer Entwickelung. Von D. Kürchhoff.

Algeria. *Ann. G.* **16** (1907): 139–147. **Rousseau.**

Dans la basse vallée de l'Oued Sahel. Notes sur les Mezzaïa, les Toudja et les Beni Ourlis. Par Robert Rousseau.

Algeria. *B.R.S.G. Madrid* **49** (1907): 226–265. **Serrano.**

Relación de un viaje hecho desde Madrid á la ziudad de Argel para redimir cautivos en el año 1670. Por fray Bartolomé Serrano.

Algeria. ———

Statistique générale de l'Algérie, 1905. Algiers, 1906. Size 10½ × 7, pp. 326 and xx.

Algeria—Commerce. **Delorme.**

Exposition Coloniale de Marseille en 1906. Le commerce algérien (rapports avec la France et l'étranger). Par P. Delorme. 2 vols. Algiers, 1906. Size 9½ × 6½, pp. (vol. 1) viii. and 492; (vol. 2) 464 and lxiv.

Algeria—Geodesy. *C.R.A. Sc. Paris* **144** (1907): 792–795. **Bourgeois and Noirel.**

Sur la forme du géoide dans la région du Sahel d'Alger. Par Bourgeois et Noirel. *With Sketch-maps.*

British West Africa. *J.R. Colonial I.* **38** (1906–7): 360–379. **Montmorres.**

The Commercial Possibilities of West Africa. By Right Hon. Viscount Montmorres.

Canary Islands—Tenerife. **Espinosa.**

The Guanches of Tenerife; the Holy Image of Our Lady of Candelaria; and the Spanish conquest and settlement, by the Friar Alonso de Espinosa. Translated and edited, with notes and an introduction, by Sir Clements Markham. (Hakluyt Society publications, Second Series, No. xxi.) London, 1907. Size 9 × 5, pp. xxvi. and 222. *Maps and Facsimile Illustrations. Presented by the Hakluyt Society.*

Cape Colony—Bechuanaland. *P. Rhodesia Sc. Ass.* **6** (1906): 73–86. **Molyneux.**

A Contribution to the Geology of the Bechuanaland Protectorate. By A. J. C. Molyneux.

Cape Colony—Buffalo River. **Schwarz.**

The Rock Channel of the Buffalo River, East London. By E. H. L. Schwarz. (From the Records of the Albany Museum, vol. 2, No. 1.) Albany, 1907. Size 9½ × 6½, pp. 18. *Section. Presented by the Author.*

See note in the September number (p. 333).

Cape Colony—Irrigation. **Leane.**

Cape of Good Hope. Fish River Surveys. Report by Mr. W. B. Leane upon Proposed Schemes at Strydom's Kraal, Cradock, with covering letter by Mr. W. B. Gordon. Cape Town, 1906. Size 13 × 6, pp. 22. *Plan and Sections.*

Cape Colony—Irrigation. **Newman.**

Cape of Good Hope. Reports on the Great Fish, Bushmans, and Sundays Rivers. By Mr. R. W. Newman, 1905. Cape Town, 1906. Size 13 × 8, pp. 20. *Sections.*

On the possibilities of irrigation from these rivers.

Congo State. **Cornoldi.**

Aristide Cornoldi. La Questione Congolese. Milano, 1907. Size 10½ × 7½, pp. 64. *Map. Presented by the Società Italiana di Esplorazioni Geografiche e Commerciali.*

The writer, who occupied an official position in the north-east part of the state

under the agreement between the Italian and Congolese Governments, gives an impartial review of the history and present condition of the state, and points out the interests which he considers it to offer to Italy.

Congo State. *M.G. Ges. Hamburg* **22** (1907): 173–200. **Frobenius.**
Kolonialwirtschaftliches aus dem Kongo-Kassai-Gebiet. Einige Beobachtungen von Leo Frobenius.

East Africa. *P. Rhodesia Sc. Ass.* **6** (1906): 118–138. **Laessoe.**
The Lundi and Sabi Rivers. By H. de Laessoe. *With Maps and Illustrations.*

East Africa. **Seaman.**
Observations in the Tropics. By Louis L. Seaman. [Reprint from the *New York Medical Journal* for September 29, 1906.] A. R. Elliott. New York, 1906. Size 8 × 5½, pp. 8. *Presented by the Author.*

During a visit to East Africa, the author paid special attention to disease and its treatment.

Egypt. **Cromer.**
Egypt. No. 2 (1907). Despatch from the Earl of Cromer respecting the water-supply of Egypt. London, 1907. Size 13 × 8½, pp. 18. *Price* 2½*d.*

See note in the Monthly Record for September (p. 332).

Egypt. ——
Survey Department, Egypt. Meteorological Report for the year 1904. Part ii. Climatological Stations, Rainfall, and River Gauge Observations. Cairo, 1906. Size 14½ × 10½, pp. x. and 46.

NORTH AMERICA.

Alaska—Bogoslof Islands. *Popular Sc. Monthly* **69** (1906): 481–489. **Jordan and Clarke.**
The Bogoslofs. By David Starr Jordan and George Archibald Clarke. *With Illustrations.*

See note in the *Journal* for February, 1907, p. 228.

Alaska—Commercial. *National G. Mag.* **18** (1907): 164–190. **Brookes.**
Railway routes in Alaska. By Alfred H. Brookes. *With Maps, Illustrations, and Diagrams.*

Alaska—Nome. *American J. Sc.* **23** (1907): 457–458. **Dall.**
On climatic conditions at Nome, Alaska, during the Pliocene, and on a new species of Pecten from the Nome Gold-bearing Gravels. By William Healey Dall, Paleontologist U.S. Geol. Survey. *With Illustration.*

America—Cartography. *B. American G.S.* **39** (1907): 202–224. **Stevenson.**
Typical early maps of the New World. By E. L. Stevenson. *With Facsimiles.*

Canada. *J.R. Col. I.* **38** (1907): 439–465. **Griffith.**
Some phases of Canada's development. By W. L. Griffith.

Canada—Geological Survey. ——
Summary Report of the Geological Survey Department of Canada for the Calendar Year 1906. Ottawa. Size 9½ × 6½, pp. vi. and 206. *Presented by the Geological Survey of Canada.*

See note in the Monthly Record for August (p. 215).

Canada—Glaciers. *P.A. Nat. Sc., Philadelphia* **63** (1906): 568–580. **Vaux.**
Observations made in 1906 on glaciers in Alberta and British Columbia. By George and William S. Vaux. *With Map and Illustrations.*

Canada—Nova Scotia. *P. and T. Nova Scotian I. Sc.* **11** (1903–04): 264–270. **McIntosh.**
The question of subsidence at Louisberg, Cape Breton. By Kenneth McIntosh.

Canada—Tides. ——
Tide tables for the Pacific Coast of Canada, 1907 . . . Ottawa, 1609. Size 9½ × 6½, pp. 28.

Mexico—Geology. *Science* **25** (1907): 710–712. **Hill.**
Geology of the Sierra Almoloya, with notes on the tectonic history of the Mexican plateau. By Robert T. Hill.

Noticed in the Monthly Record (July, p. 93).

Mexico—Volcanoes. *Scottish G. Mag.* **23** (1907): 281–312. **Cadell.**
Some old Mexican volcanoes. By Henry M. Cadell. *With Maps and Illustrations.*

North America—Ethnology. **Hodge.**
Smithsonian Institution: Bureau of American Ethnology, Bulletin 30. Handbook of American Indians north of Mexico. Edited by Frederick Webb Hodge. Part i. Washington, 1907. Size 9½ × 6, pp. x. and 972. *Map and Illustrations.*

United States. **Johnson.**
Report on the Geological Excursion through New Mexico, Arizona, and Utah, summer of 1906. By Douglas Wilson Johnson. (Reprinted from *Technology Quarterly*, vol. 19, No. 4, December, 1906.) Size 10½ × 7, pp. 408–415.

United States—Florida. **Millspaugh.**
Field Columbian Museum Publs., Botanical Ser. **2** (1907), 189–246.
Flora of the Sand Keys of Florida. By Charles Frederick Millspaugh. *With Maps.*
Noticed in the Monthly Record.

CENTRAL AND SOUTH AMERICA.

Argentine—Archæology. **Ambrosetti.**
Exploraciones arqueológicas en la Pampa grande (Provincia de Salta). Por Juan B. Ambrosetti. (De la *Revista de la Universidad de Buenos Aires*, 1906, Tomo v.) Buenos Aires, 1906. Size 10½ × 7, pp. 200. *Maps and Illustrations.*

Argentine—Levelling. **Lelli.**
An. S. Cient. Argentina **62** (1906): 137–152, 202–208, 243–250.
La nivelación de precisión en la República Argentina. Por Aduino Lelli.

Argentine—Patagonia. **Ameghino.**
Ann. Museo Nacional, Buenos Aires **8** (1906): pp. 568.
Les formations sédimentaires du crétacé superieur et du tertiaire de Patagonie. Par Florentino Ameghino. *With Illustrations.*

Bolivia. **Neveu-Lemaire.**
Mission scientifique G. de Créqui Montfort et E. Sénéchal de la Grange. Les lacs des hauts plateaux de l'Amérique du Sud. Par le Dr. M. Neveu-Lemaire. Paris: H. le Soudier, 1906. Size 11 × 7½, pp. vi. and 198. *Maps and Illustrations. Price* 7.50 *fr. Presented by the Publisher.* [To be reviewed.]

Bolivia. **Calderon.**
Bolivia. Address delivered by Mr. Ignacio Calderon . . . Washington, 1907. Size 9 × 6, pp. 22. [In Spanish and English.]
On the development and present condition of Bolivia.

Brazil. *J. Geology* **15** (1907): 218–237. **Derby.**
The sedimentary belt of the coast of Brazil. By Dr. Orville A. Derby. *With Sketch-map.*

Brazil—Amazon. *Ann. G.* **16** (1907): 159–174. **Le Cointe.**
Notice sur la carte du cours de l'Amazone et de la Guyane brésilienne depuis l'océan jusqu'à Manaos. Par Paul Le Cointe. *With Map.*
The map—on the scale of 1 : 2,000,000—is an attempt to correlate the results of all previous journeys with the author's own observations.

Chile and Argentina—Boundary. **Patron.**
Republica de Chile: Oficina de Limites. La linea de frontera con la República Arjentina entre las latitudes 27° i 31° S. Por Luis Riso Patron S. Santiago de Chile, 1907. Size 11 × 8, pp. 190. *Maps and Illustrations. Presented by the Oficina de Limites, Chile.*

Peru. **Clairmont.**
Guide to modern Peru: its great advantages and unique opportunities. By A. de Clairmont. Toledo, Ohio, 1907. Size 7¾ × 5¼, pp. 80. *Illustrations. Presented by the Author.*

Peru. **Enock.**
The Andes and the Amazon: life and travel in Peru. By C. Reginald Enock. London: T. Fisher Unwin, 1907. Size 9 × 5½, pp. xvi. and 380. *Map and Illustrations. Price* 21*s. Presented by the Publisher.* [To be reviewed.]

AUSTRALASIA AND PACIFIC ISLANDS.

New Guinea—British. ——

British New Guinea. Annual report for the year ending June 30, 1906. Melbourne, 1907. Size 13 × $8\frac{1}{4}$, pp. 94. *Sketch-maps and Illustrations.*

New Guinea—Dutch. *Ts. K. Nederlandsch Aard. Genoots.* **24** (1907): 466–471. **Lorentz.**

De Nieuw-Guinea Expeditie van de "Maatschappij ter Bevordering van het Natuurkundig Onderzoek der Ned. Kolonien," en het "Indisch Comité voor Wetenschappelijke Onderzoekingen:" Door H. A. Lorentz.

Describes the organization and plans of this expedition, which lately left Batavia for the south coast of Dutch New Guinea.

Pacific Islands. **Elkington.**

The savage South Seas; painted by Norman H. Hardy; described by E. Way Elkington. London: A. & C. Black, 1907. Size 9 × 6, pp. xii. and 212. *Illustrations. Price 20s. net. Presented by the Publishers.*

See Review, *ante.*

Pacific Ocean. *National G. Mag.* **18** (1907): 205–208. **Hague.**

A Recent Report from the "Doubtful Island Region." By James D. Hague. *With Maps.*

The existence of a reef in the north-east Pacific (cf. *Journal*, vol. **25**, p. 331) was reported by the commander of the French barque *Michelet* early in the present year.

Samoa—Savaii. *M.k.k.G. Ges. Wien* **50** (1907): 28–37. **Rechlinger.**

Ausflug zu dem neuentstandenen Krater auf der Insel Savaii (Samoa) im August 1905. Von Dr. Karl und L. Rechlinger.

Western Australia—Zoogeography. *M.G. Ges. Hamburg* **22** (1907): 35–68. **Michaelsen.**

Die Tierwelt Südwest-Australiens und ihre geographischen Beziehungen. Von Dr. W. Michaelsen. *With Sketch-maps.*

Western Australia. *J.R. Col. I.* **38** (1907): 275–294. **Rason.**

The Resources of Western Australia. By Hon. C. H. Rason.

POLAR REGIONS.

Antarctic. **Nordenskiöld and others.**

Wissenschaftliche Ergebnisse der schwedischen Südpolar-Expedition, 1901–1903, unter Leitung von Dr. Otto Nordenskiöld. Band IV. Lieferung 5 (pp. 16); Lieferung 6 (pp. 172); and Band V. Lieferung 9 (pp. 22). Stockholm, 1906–7. Size 11 × $8\frac{1}{2}$. *Map and Plates.*

These parts deal with the collections of marine algæ, collembola, etc.

Antarctic—Belgian Expedition. **Arçtowski.**

Plan de voyage de la Second Expédition Antarctique Belge. Par Henryk Arçtowski. Vanderauwera & Co., Bruxelles, 1907. Size 9 × 6, pp. 16.

Antarctic—Belgian Expedition. **Arçtowski.**

Programme Scientifique de la Seconde Expédition Antarctique Belge. Par Henryk Arçtowski. Bruxelles: Ferdinand Larcier, 1907. Size $9\frac{1}{2}$ × 6, pp. 16.

Antarctic—Geology. ——

National Antarctic Expedition, 1901–1904. Natural History. Vol. 1. Geology (Field-geology: petrography). London, 1907. Size $12\frac{1}{2}$ × 9, pp. xii. and 160. *Maps and Illustrations. Price 30s. Presented by the British Museum (Natural History).*

Arctic. *La G., B.S.G. Paris* **15** (1907): 233–252. **Amundsen.**

Vers le Pôle magnétique boréal par le passage du Nord-Ouest. Par Roald Amundsen.

Arctic. *B. American G.S.* **39** (1907): 224–231. **(Mikkelsen and Stefansson.)**

(Letters from Captain Einar Mikkelsen and V. Stefansson.) *With Map.*

Arctic—Norwegian Expedition. **Isachsen.**

Report of the Second Norwegian Arctic expedition in the *Fram*, 1898–1902. No. 5. Astronomical and Geodetical Observations. By Gunnar Isachsen. Christiania, 1907. Size 11 × 7, pp. 142. *Maps and Illustrations.*

MATHEMATICAL GEOGRAPHY.

Astronomy—Moon. *C.R.A. Sc. Paris* **144** (1907): 1193–1195. **Loewy and Puiseux.**
Sur l'origine des accidents du sol lunaire. Par Loewy et Puiseux.

Cartography—Historical. *Rev. G. Col. y Mercantil* **4** (1907): 155–159. **Blázquez.**
Tres cartas nauticas del siglio xvi. Por A. Blázquez.

These charts, one of which embraces the basin of the Mediterranean with the west coasts of Spain and Morocco, the others portions of the same area on a larger scale, seem to show a connection with the order of St. John of Jerusalem.

Cartography—Statistical Maps. **Mayr.**
Zur Methodik und Technik statistischer Karten. Von Dr. Georg v. Mayr. (Separat-Abdruck aus dem Allgemeinen statistischen Archiv, VII. Band, Erster Halbband.) Tübingen, 1907. Size 9 × 6, pp. 131–157.

Geodesy. **McCaw.**
The Progress of Geodesy. By G. T. McCaw. (Read before the Institution of Civil Engineers of Ireland, May 1, 1907.) Dublin, 1907. Size 8½ × 5½, pp. 42. *Map and Illustrations. Presented by the Author.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Climatology. *J.G.* **5** (1906): 302–319, 339–353, 395–405, 433–450. **Ward.**
The Characteristics of the Zones. By Robert De C. Ward. *With Maps and Diagrams.*

Coasts. *J.S. Arts* **55** (1907): 650–667. **Carey.**
The Protection of Sea-shores from Erosion. By Alfred Edward Carey. *With Illustrations and Diagrams.*

Coasts. *C.R.A. Sc. Paris* **144** (1907): 938–940. **Thoulet.**
Sur la marche des sables le long des rivages. Par Thoulet.

Erosion. *Atti R.A. Lincei, Rendiconti, Ser.* v. **16** (1907), 1 *Sem.*, 571–575. **Fischer.**
Fenomeni di abrasione sulle coste dei paesi dell' Atlante. Di Teobaldo Fischer.

Erosion. *P.R.S. Victoria* **19** (1907): 54–59. **Leach.**
Surface tension as an aid in canyon formation, the production of bad lands, and in river capture. By J. A. Leach. *With Diagrams.*

The writer holds that the tendency of water to adhere to surfaces is an important factor in processes of erosion, as it helps the wearing away of softer layers of rock or soil by undercutting.

Geomorphology. **Götzinger.**
G. Abhandlungen (Penck) **9** (1907): Heft 1, pp. iv. and 174.
Beiträge zur Entstehung der Bergrückenformen. Von D. Gustav Götzinger. *With Maps, Diagrams, and Illustrations.*

Geomorphology—Erosion. *C.R.A. Sc. Paris* **144** (1907): 936–938. **Brunhes.**
Sur les relations entre l'érosion glaciaire et l'érosion fluviale. Par Jean Brunhes.

Geophysics. *P.R.S.* 79 (1907): *Ser. A.*, 194–199. **Love.**
The gravitational stability of the earth. By A. E. H. Love.

Historical—Travel. **Adler.**
The Itinerary of Benjamin of Tudela. Critical text, translation, and commentary by Marcus Nathan Adler. London: H. Frowde, 1907. Size 9 × 5½, pp. xvi., 94, and [100]. *Map and Facsimiles. Price 5s. net. Presented by the Publisher.*

This is not merely an English version of the edition reviewed in vol. 27, p. 83, in which Dr. Adler's name appears as joint editor with that of Dr. Grünhut of Jerusalem. The translation and notes are here the work of Dr. Adler alone. The edition will prove of great use to students, and, while not intended to supplant the standard work of Asher, it is valuable as presenting the results of more recent research.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography—Climate and Man. **Tyler.**
The psycho-physical aspect of climate, with a theory concerning intensities of sensation. By W. F. Tyler. (Reprinted from the *Journal of Tropical Medicine*

and Hygiene, April 15, 1907.) London, 1907. Size 9½ × 6, pp. 46. *Diagrams. Presented by the Author.*

Anthropogeography—Migrations. *J. Anthropological I.* **36** (1906): 189–220. Petrie.
Migrations. By Prof. W. M. Flinders Petrie. *With Maps and Illustrations.*

BIOGRAPHY.

Dapper—Bibliography. Schuller.
Novus Orbis. De A. Montanus o de O. Dapper? Por R. R. Schuller. [Santiago, N.D.] Size 9½ × 6, pp. 18. *Facsimiles. Presented by the Author.*

The writer lays it down that Montanus was but a pseudonym of Dapper. (See note in the Monthly Record, November, p. 568.

Fanshawe. Fanshawe.
The memoirs of Ann Lady Fanshawe, wife of the Right Honourable Sir Richard Fanshawe, Bart., 1600–72, reprinted from the Original Manuscript in the possession of Mr. Evelyn John Fanshawe of Parsloes, with four photogravure portraits and twenty-nine other reproductions. London: John Lane, 1907. *Presented by the Editor.*

The editor, Mr. H. C. Fanshawe, supplies copious notes embodying all the fresh information he has been able to glean concerning Sir Richard Fanshawe and his wife. The memoirs are occasionally of geographical interest, as they describe various journeys, including that from Cadiz to Madrid made at the time of Sir Richard's appointment as ambassador to the court of Spain.

GENERAL.

British Colonies. ——
Emigration: Memorandum on the History and Functions of the Emigrants' Information Office. 1907. London, 1907. Size 13 × 8½, pp. 10. *Diagrams. Price 6d.*

Includes statistics on emigration to the colonies.

British Empire. Hearnshaw.
The Empire and the Schools. By F. J. C. Hearnshaw. (From the *School World*, June, 1907.) London, 1907. Size 10½ × 7½, pp. 204–208.

Contains a useful bibliography of school books on the British Empire.

British Empire. ——
Minutes of Proceedings of the Colonial Conference, 1907. London, 1907. Size 13½ × 8½, pp. x. and 622. *Price 5s.*
Papers laid before the Colonial Conference, 1907. London, 1907. Size 13 × 8½, pp. x. and 592. *Price 4s. 9d.*

Educational. Das.
The Modern Geography. No. 1 (for beginners). By B. B. Das. Third edit. Calcutta, 1905. Size 7 × 5, pp. 68. *Maps. Presented by the Author.*

Consists mostly of lists of names, etc., with slight attempt at explanation of phenomena.

Educational. Gibbs.
The Pedagogy of Geography. By David Gibbs. (Reprinted from the *Pedagogical Summary*, March, 1907, vol. 14. Size 9½ × 6, pp. 39–100.) *Presented by the Author.*

NEW MAPS.

By E. A. REEVES, ***Map Curator,*** **R.G.S.**

EUROPE.

England and Wales. **Ordnance Survey.**
Sheets published by the Director-General of the Ordnance Survey, Southampton, from October 1 to 31, 1907.

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25-inch—County Maps:—

Cornwall (First Revision), XLVII. 16; LVI. 12; LVII. 5, 6, 7, 8, 9, 10, 11, 12; LVIII. 9, 10, 13, 16; LIX. 13, 14, 16; LXIV. 3, 4, 6, 8, 10, 12; LXV. 1, 2, 4, 5, 6, 8, 9, 12, 13; LXVI. 1, 3, 6; LXXX. 5, 6, 7, 8 (10 and 9), 11, 12, 14, 15, 16; LXXXI. 5, 6, 7, 8, 9, 10, 11 (12 and 16), 13, 14, 15 (16 and 12); LXXXIV. 2, 3, 4, 6, 7, 8, 11, 12, 15, 16; LXXXV. 1, 2 (3, 6, and 7), (5 and 9), (6, 7, and 3), (9 and 5). **Kent** (Second Revision), XXIV. 15; XXXV. 4, 15; XLIV. 8, 12, 16; XLV. 5, 9, 13; XLVI. 2, 5; LIV. 4, 6, 7, 8, 10, 11, 12; LV. 1, 5, 9, 15, 16; LVI. 13; LXV. 2, 4, 12, 16; LXVI. 5, 9, 13; LXVIII. 5; LXXIII. 4. 3s. *each.* **Lancashire** (First Revision of 1891 Survey), CI. 12; CII. 1, 2, 4, 5, 6, 8; CVIII. 14; CX. 4. **Lincolnshire** (First Revision), IX. 8, 14, 15; X. 2, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16; XI. 1, 6, 7, 8, 10, 11, 12, 14, 15; XIII. 15, 16. **Norfolk** (First Revision), L. 16; LI. 13, 14; LXII. 12; LXIV. 6, 7, 8, 10, 11, 12, 14, 15, 16; LXV. 9, 13; LXXIV. 4; LXXV. 2; LXXVI. 1, 2, 3, 4; LXXVII. 1, 14. **Pembrokeshire** (First Revision), IV. 10; VIII. 12; XV. 2, 3, 9, 10, 11, 12, 13, 14, 15, 16; XVI. 7, 9, 13, 14, 15, 16; XXI. 3, 7, 8; XXII. 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 16; XLI. 12. **Yorkshire** (First Revision of 1891 Survey), CCXXIX. 8, 15; CCXXX. 2, 3, 4, 5, 6, 7, 9, 10, 12, 14; CCXXXI. 14; CCXXXVI. 1, 2, 3, 7, 9, 10.

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Staffordshire, 13 N.W., 19 N.W., N.E., S.W. 1s. 6d. *each.*

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France. **Ministre de l'Intérieur, Paris.**

Carte de la France dressée par ordre du Ministre de l'Intérieur. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets: xiv.-19, Amboise; xvi.-14, Dourdan; xix.-17, Auxerre; xxiii.-12, Verdun; xxiv.-34, Salernes; xxv.-17, Luxeuil. New editions. Paris: Ministère de l'Intérieur, Service Vicinal, 1907. *Price* 0.80 *fr. each sheet.*

Germany. **Vogel.**

Karte des Deutschen Reichs. Unter Reduktion von Dr. C. Vogel, ausgeführt in Justus Perthes Geographischer Austalt in Gotha. Scale 1 : 500,000 or 1 inch to 7·9 stat. miles. 27 sheets. Gotha: Justus Perthes, 1907.

A new edition of a map that first appeared in 1891.

Portugal. **Direcção Geral dos Trabalhos Geodesicos e Topographicos.**

Carta de Portugal. Scale 1 : 50,000 or 1·3 inch to 1 stat. mile. Sheets: 16-*d*, Constancia; 17-*b*, Cadaval; 17-*c*, Santarem. Lisbon: Direcção Geral dos Trabalhos

Geodesicose Topographicos. *Price* 300 *reis per sheet.* ***Presented by the Direcção Geral dos Trabalhos Geodesicos e Topographicos, Lisbon.***

Three additional sheets of the new Government survey of Portugal. Contour-lines, in brown, are given at intervals of 25 metres; roads in red, water blue and wooded lands green. Altogether the map is being most satisfactorily produced, and is very clear and effective. The present sheets include Santarem and the districts immediately to the west and north-east. Six sheets of the survey have now been published, the three others comprising the neighbourhood of Aveiro.

ASIA.

Armenia. **Oswald.**

A geological map of Armenia and its border-ranges, with indications of minerals and mineral springs. Drawn and hand-coloured by Felix Oswald, D.SC., F.G.S. Scale 1 : 1,013,760 or 1 inch to 16 stat. miles. London: Dulau & Co., 1907. *With Explanatory Notes.*

Dr. Felix Oswald accompanied Mr. H. F. B. Lynch on his second journey through Turkish Armenia in 1898, with the object of investigating the physical geography and geology of the country, and this geological map gives the generalized results of his researches and observations. The map is accompanied by a pamphlet of sixteen pages of explanatory notes; but the fuller 'Treatise on the Geology of Armenia,' which was published by the author last year, and was accepted by the University of London for the degree of Doctor of Science, gives the details of Dr. Oswald's investigations, and is accompanied by numerous diagrams and maps. The above map, which may be considered as a supplement to the work just referred to, contains a large amount of detailed information. In its production other authorities have been consulted, and these are all mentioned in the title. The map is a photo-lithographic facsimile of the author's own drawing, coloured by hand, so it has a somewhat unprofessional appearance; but the information contained is most valuable. Only a few copies have been printed off.

Persia and Afghanistan. **Topographical Section, General Staff.**

Persia and Afghanistan. Scale 1 : 4,055,040 or 1 inch to 64 stat. miles. London: Topographical Section, General Staff, War Office, 1906. *Price* 2*s.* 6*d.* ***Presented by the Director of Military Operations.***

This is a good general map of Persia, Afghanistan, and Baluchistan, with the neighbouring parts of Russian Turkestan and India, showing height of land by means of approximate contours and colour tinting. Land from sea-level to 500 feet is left white, after which follow nine tints of buff and brown, increasing in intensity with the altitude, and ranging from intervals of 500 feet to 5000 feet up to over 20,000 feet. Only the names of important places are given, and the map is not obscured by unnecessary detail, so that the tinting is effective, and clearly indicates at a glance the general relief of the region. Special attention has been paid to railways, roads, and telegraphs, and in connection with the former the gauge is indicated by the symbol employed.

AFRICA.

Algeria. **Jonnart.**

Algérie Nord. Carte dresée par ordre de M. Jonnart, Gouverneur-Général de l'Algérie. Scale 1 : 800,000 or 1 inch to 12·6 stat. miles. 2 sheets. Esquisse du Sahara Algérien. Carte dressée par ordre de M. C. Jonnart, Gouverneur Général de l'Algérie. Scale 1 : 2,500,000 or 1 inch to 39·5 stat. miles. Algiers: Gouvernement Général de l'Algérie, 1907. *Presented by the British Consul, Algiers.*

These are two outline maps, without hill features, showing clearly the limits of departments, communes, and other territorial divisions. The location of tribes is also a special feature, whilst the principal routes, railways, wells, and watercourses are indicated.

Dahomey. **Service Géog. de l'Afrique Occidentale Française, Paris.**

Carte du Bas-Dahomey. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheet 1. Grand Popo. Paris: Service Géographique du Gouvernement Général de l'Afrique Occidentale Française, 1907. *Price* 1.50 *fr. each sheet.*

The provisional issue of the south-west sheet of a new French official map, compiled from route traverses, railway surveys, and other information. When complete, the map will consist of eight sheets.

Egypt. **Survey Department, Cairo.**

Topographical map of Fayum Province. Scale 1 : 10,000 or 6·3 inches to 1 stat.

mile. Sheet: s.w. 16–3. Cairo: Survey Department, 1907. *Presented by the Director-General, Survey Department, Cairo.*

German East Africa. **Sprigade and Moisel.**

Karte von Deutsch-Ostafrika. Begonnen unter Leitung von Dr. Richard Kiepert, fortgesetzt unter Leitung von Paul Sprigade und Max Moisel. Scale 1 : 300,000 or 1 inch to 4·7 stat. miles. Sheet: C 2, Rutschugi-Posten. Berlin: Dietrich Reimer, 1906. *Presented by the Publisher.*

Gold Coast. **Guggisberg.**

Map of the Gold Coast. Published by the authority of Sir John Pickersgill Rodger, K.C.M.G., Governor, under the direction of Major F. G. Guggisberg, R.E., F.R.G.S., Director of Surveys, Gold Coast. Scale 1 : 125,000 or 1 inch to 1·9 stat. mile. Sheets: 72-L-IV., Komfrodua; 72-Q-IV., Cape Coast; 72-R-I., Nsaba; 72-R-III. and 72-R-IV., Winneba and Nianyano. Edinburgh and London: W. & A. K. Johnston, 1907. *Price 2s. each sheet. Presented by Major F. G. Guggisberg, R.E., Director of Surveys, Gold Coast.*

South Africa. **Bartholomew.**

Bartholomew's reduced survey map of South Africa, coloured to show height of land. Scale 1 : 2,500,000 or 1 inch to 39·5 stat. miles. Edinburgh: John Bartholomew & Co., [1907]. *Price 3s. Presented by the Publisher.*

This is a new edition, with railways revised and corrected to date.

AMERICA.

Brasil. **Commissão Geographica e Geologica de S. Paulo.**

Topographical map of the State of Sao Paulo. Scale 1: 100,000 or 1 inch to 1·5 stat. mile. Sheets: Atibai, Botucatu, Campinas, Casa Branca, Jahu, Pindamonhangaba, Pirassununga, Rio Claro, S. Carlos do Pinhal, S. Paulo, S. Roque. Sao Paulo: Commissão Geographica e Geologica, 1906-1907. *Presented by the Geographical and Geological Commission of the State of Sao Paulo.*

With the exception of the "S. Roque" sheet, these are new editions of the sheets noticed in the *Geographical Journal* for April, 1906. Contour-lines in brown show altitudes at intervals of 25 metres, water is in blue, and roads, railways, and lettering black.

Canada. **Dept. of the Interior, Ottawa.**

Sectional map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheet: Prince Albert South, revised to September 4, 1907. Ottawa: Department of the Interior, Topographical Surveys Branch, 1907. *Presented by the Department of the Interior, Ottawa.*

Canada. **Dept. of Agriculture, Ottawa.**

Maps of Alberta, Manitoba, and Saskatchewan, showing population according to the censuses of 1901 and 1906. Sale 1: 792,000 or 1 inch to 12·5 stat. miles. Ottawa: Department of Agriculture, 1907. *Presented by James White, Esq., Geographer, Department of Agriculture.*

From an inspection of these maps a better idea of the rapid increase in the population of the provinces of Manitoba, Saskatchewan, and Alberta can be obtained than would be possible in a much longer time by consulting tables of statistics. Upon the maps are shown, in addition to general geographical features, the limits of the numerous townships, and in each of these clear figures in blue and red indicate the population according to the censuses of 1901 and 1906 respectively. The population of the cities, towns, villages, and electoral divisions is shown in each case by tables, as insets, and these figures are not included in those given on the maps themselves. Mr. White may be congratulated upon the production of these maps, which should be most useful and instructive. They are not obscured by unnecessary detail, and no hill-shading is given.

Chili. **Oficina de Limites, Santiago.**

Comision Chilena de Limites. Scale 1: 250,000 or 1 inch to 3·9 stat. miles. Sheets: Atacama and Llanquihue. Santiago: Oficina de Limites, 1907. *Presented by the Oficina de Limites, Santiago.*

The "Atacama" sheet includes the area between lat. 26° to 27° S. and long. 67° 30′ to 69° 20′, and shows the Salar de Pedernales, Salar de Maricunga, and Salar de Antofaya, while the Llanquihue sheet embraces the Rio Aisen, Rio Simpson, and Laguna Blanca region, extending from lat. 45° to 46° S., and from long. 70° 30′ to 73° W. As before, each topographical sheet is accompanied by another on the same

scale, showing the traverse lines and intersected points upon which the survey depends.

Newfoundland. **Howley.**

Geological map of Newfoundland, compiled from the most recent and authentic sources by James Howley, F.G.S., Director of the Geological Survey of Newfoundland. Scale 1 : 443,520 or 1 inch to 7 stat. miles. St. Johns: Geological Survey of Newfoundland, 1907. *Presented by James Howley, Esq.*

This map measures 60 × 53 inches, and clearly indicates the leading geological features of the island by the usual system of colouring, as well as the location of minerals, which are shown by symbols and letters. As many areas of the island are still very imperfectly known geologically, it is quite possible that in time to come considerable modifications and alterations will be found necessary, but for the present this will prove a most useful map.

GENERAL.

World. **Harmsworth.**

Harmsworth Atlas and Gazetteer. 500 maps and diagrams, and 105,000 references. Parts 26 and 27. London: The Amalgamated Press, Ltd., 1907. *Price 7d. each part.*

These parts contain the following maps: Part 26, Nos. 53–54, Scotland; 105–106, Asia Minor and Armenia; 203–204, Queensland. Part 27, Nos. 63–64, Western Switzerland; 161–162, Upper Canada; 209–210, New Zealand.

World. **Schrader.**

L'Année Cartographique. Supplément annuel a toutes les publications de géographie et de cartographie, dressé et rédigé sous la direction de F. Schrader. Dix-septième année contient les modifications géographiques et politiques de l'année, 1906. Paris: Hachette et Cie, 1907. *Price 3 fr. Presented by the Publisher.*

This year's issue of Schrader's 'l'Année Cartographique' is similar in appearance and general arrangement to those of earlier years. It consists of three sheets, the first of which is devoted to Asia, the second to Africa, and the third to America and the North Polar region. Each of these consist of a series of maps, with text on the back, dealing with the principal geographical explorations and boundary delimitations during the year 1906, among the more important being Major C. D. Bruce's journey from Leh to Peking, A. F. Stahl's routes in Persia, the finally arranged boundary between Northern Nigeria and French Sudan, and Captain Amundsen's remarkable voyage through the North-West Passage.

World. **Sipman.**

Globus-Karte. Weltkarte in Teilkarten in einheitlichen Flachenmassstabe mit einer statistischen Tabelle der selbstandigen Staaten und der deutschen Kolonien entworfen und herausgegeben von Hauptmann Sipman. Berlin: Dietrich Reimer (Ernst Vohsen), 1907. *Price 1 m. Presented by the Publisher.*

As stated in the title, this is a map of the world in sections, on an equal-area projection. The sections, of which there are six in number, each embracing sixty degrees of longitude, have much the appearance of gores of a globe, but instead of the circles of latitudes being curved, they are shown by straight lines parallel with the equator, and at equal distances apart. Along the parallels the value of each ten degrees of longitude is marked off, and through these points pass the meridians, three on each side of the central meridian of each section. The result is an equal-area projection; but it is difficult to see what special advantage it possesses, and in the northern and southern regions numerous overlaps and duplications fill up the spaces between the wedge-shape gores, tending to confusion rather than serving any useful purpose.

CHARTS.

Indian Ocean and Red Sea. **Meteorological Office.**

Monthly meteorological chart of the Indian Ocean north of 15° S. lat. and Red Sea, November, 1907. London: Meteorological Office, 1907. *Price 6d. each. Presented by the Meteorological Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Monthly meteorological chart of the North Atlantic and Mediterranean, November, 1907. London: Meteorological Office, 1907. *Price 6d. each. Presented by the Meteorological Office.*

North Atlantic. **U.S. Hydrographic Office.**

Pilot chart of the North Atlantic ocean, October, 1907. Washington: U.S. Hydrographic Office, 1907. *Presented by the U.S. Hydrographic Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot chart of the North Pacific ocean, November, 1907. Washington: U.S. Hydrographic Office, 1907. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Asia Minor and Persia. **Douglas.**

Seventy-nine photographs of Asia Minor and Persia, taken by Lieut.-Colonel J. A. Douglas, I.A. *Presented by Lieut.-Colonel J. A. Douglas.*

Colonel J. A. Douglas' interesting series of photographs include Trebizond, on the Black sea, Tehran, thence south and east through Persia to Isfahan, the Bakhtiari country, and Seistan. The following are the titles:—

(1 and 2) Trebizond; (3 and 4) Kerasunda; (5) Ineboli; (6) Riva; (7) In the Black sea; (8 and 9) Deck passengers on steamer in the Black sea; (10) A street in Tehran; (11) The British Legation at Tehran; (12) In the bazaar at Tehran; (13) Dr. Sven Hedin at Tehran; (14 and 15) In the hills near Tehran; (16) A camp in the hills near Tehran; (17) In the hills near Tehran, looking south from the Kandevan pass; (18–21) In the Lar valley near Tehran; (22 and 23) Persian nomads in the Lar valley, milking sheep; (24 and 25) Persian nomads in the Lar valley, churning milk; (26 and 27) In the Legation garden at Gulahek; (28) The cone of Mount Demavend; (29) In the Mazanderan hills; (30) Pass on the Kazvin-Hamadan road; (31) Ab-i-zarin; (32) A midday halt; (33) Persia women travelling; (34) A Persian merchant; (35) A family removal; (36) A travelling carriage in North Persia; (37) The Maidan at Isfahan; (38) Bridge at Isfahan; (39) Prince Bahrain Mirza at Isfahan; (40) A travelling carriage on the road to Isfahan; (41) Mosque at Kum; (42 and 43) The old bridge at Shuster; (44) Crossing the Karun on a skin-raft at Shuster; (45) A steamer on the Karun; (46) Old bridge at Dizful; (47) The British Consulate General at Meshed; (48) In the desert of East Persia; (49) Ahingaran gorge, East Persia; (50) Village of Duruh; (51) A village scene in East Persia; (52) A camp in East Persia; (53) Guard of Persian soldiers; (54) Persian soldiers drilling; (55) A caravanserai in East Persia; (56) Gorge on the Askhabad-Meshed road; (57) Village of Sangun; (58) Kala-i-Tal in the Bakhtiari country; (59–61) Rock carvings at Malamir; (62 and 63) Nomads on the march, Bakhtiari country; (64) In the Bakhtiari country; (65) Deh Diz; (66) Bridge at Dopolan; (67) Looking down the gorge from the Dopolan bridge; (68) The Seistan commission camp; (69 and 70) Fort Nad-i-ali, Afghan Seistan; (71) A gymkhana in Seistan, the audience; (72) The British Consulate in Seistan; (73–75) Ruins at Sar-o-Tar, Seistan; (76) Camels crossing the Helmand; (77 and 78) Afghan cavalry; (79) Baluch chief.

Asiatic Turkey. **Maunsell.**

Thirty-two photographs of the Hejaz railway, taken by Lieut.-Colonel F. R. Maunsell, C.M.G., R.A. *Presented by Lieut.-Colonel F. R. Maunsell, C.M.G., R.A.*

These photographs are of more than ordinary importance and interest, and are a valuable addition to the Society's collection. Very little is known in this country of the line followed by the Hejaz railway, and Colonel Maunsell has taken advantage of the opportunity afforded him on his recent visit to obtain an excellent series of views which give a good idea of the places through which the line passes, and the desert nature of the scenery along the line. The photographs are extremely good and clear. They are as follows:—

(1) Street scene in Damascus, showing electric tramways and es Sabunie Mosque; (2) Street in Damascus with es Sabunie Mosque; (3) El Kadem station, Damascus, with repairing works; (4) Bawaubet Allah, Damascus, starting-place of Mecca pilgrimage; (5) Street in old Damascus; (9) Maan station; (7) Maan station, general view of western end; (8) Maan station, general view from hill to north; (9) Batn-el-Ghrul escarpment from the east; (10) Batn-el-Ghrul escarpment, south-west side; (11) Southern approach to Batn-el-Ghrul along the Wadi Rutm; (12) Watchmen's tents near Kelaat-i-Mudeverre; (13 and 16) Pilgrim route to Mecca, Kala of Zat-el-Haj; (14) Station of Kelaat-i-Mudeverre; (15) Country west of line near Kelaat-i-Maudeverre; (17) Typical view in desert, east of Zat-el-Haj; (18) Hills of Haraat-i-Ahmar from the north; (19) Country east of line near Tebuk; (20) Hills east of line near Zat-el-Haj; (21) Approach to Haraat-i-Ahmar from the south; (22) Oasis of Tebuk, Kala of Tebuk; (23) Oasis of Tebuk, Bedouin tent; (24) Oasis of Tebuk, view from south-east; (15) View of northern end of Oasis of Tebuk; (26 and 27) Oasis of Tebuk, springs near

Kala; (28) Tebuk station; (29) Oasis of Tebuk from the south; (30) Hejaz railway, travelling Mosque carriage; (31) Railway truck with passengers; (32) Deraa junction, Albanian labourers for the line.

Congo State. **David.**

Two photographs of Wambitti Pygmies of the Semliki forest, near Mbeni, taken by Dr. T. David. *Presented by Dr. G. Schweinfurth.*

Carefully arranged groups of these remarkable little people, taken by Dr. David in his journey during 1904, a short account of which appeared in the *Geographical Journal* for September, 1904.

Java and Sumatra. **Hincks.**

Fifty-four photographs of Java and Sumatra, taken by Captain T. C. Hincks in 1903. *Presented by Captain T. C. Hincks, Royal Berks. Regt.*

An excellent little series of photographs of considerable interest taken in the islands of Java and Sumatra, including volcanic craters, ancient temples, types of buildings, railways, and other interesting subjects.

Java:—(1-4) Buitenzorg gardens, near Batavia; (5) Peak of Pangorango; (6) Pangorango, with crater of Gede in foreground; (7) Native hut on side of Gede; (8) Hot stream on path up Gede; (9) Waterfall at Chibodas; (10) Street scene, Chanjur; (11) Paddy fields near Garut; (12) Paddy fields and irrigation terraces; (13) Road scene near Garut; (14) View inside crater, Papandayan volcano; (15) Sulphur pillar, Papandayan; (16 and 17) Crater of Papandayan; (18) Boiling spring, Lake Telaga Bodas; (19) Native house and compound near Garut; (20 and 21) Street scene, Suerakarta; (22) Bhuddist temple at Boro-Codoer; (23-24) Temples at Brambanan; (25) Figures at entrance to one of the temples, Brambanan; (26) The peak of Smeroe from Mungal pass; (27) Batok peak and the Sand sea from Mungal pass; (28) Batok peak from edge of Bromo crater; (29) Punduq-lembu from the Bromo; (30) The Sand sea; (31) Western wall of the Sand sea; (32) Cultivation in steep valleys near Tosari; (33) Wonokitri village, looking towards Tosari; (34) Cutting paddy near Lawang; (35) Natives harvesting paddy; (36) Paddy fields in plain near Lawang.—Sumatra:—(37) Native boats, Bawean island; (38) Coal sheds, Sabang; (39) S.S. *van Swoll* at Olehleh; (40) Olehleh from the sea; (41) Lake and village of Maninjo; (42) Lake Maninjo; (43) Gorge at Harau; (49) Gorge at Harau, looking up; (45) Native houses at Harau; (46) Street in Harau; (47) Railway station at Sungei Lassi; (48) Lake Sinkarah from Batu Jabal; (49) Paddy fields near Sinkarah village; (50) Native house and rice barn, near Padang; (51) Street scene, Paya Kombo; (52 and 53) Crater of Merapi volcano; (54) Singalang mountain from Merapi crater.

Russia and Rumania. **Wilkinson.**

Forty-eight photographs representing Jewish towns and life in Russia and Rumania, taken by the Rev. S. H. Wilkinson. *Presented by the Rev. S. H. Wilkinson.*

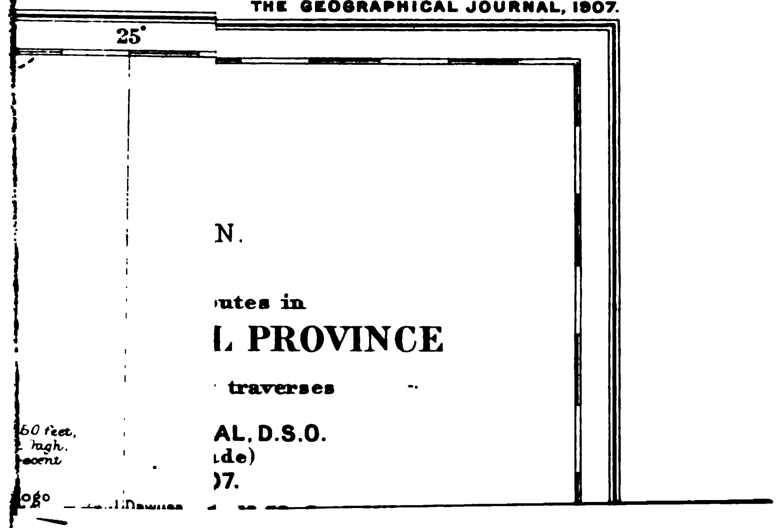
The Rev. Samuel H. Wilkinson, as superintendent of the Mildmay Mission to the Jews, has had opportunities for gaining an acquaintance with Jewish life in Russia and Rumania not afforded to many, and these photographs, which he has been good enough to present to the Society, are therefore of considerable importance.

Russia:—(1 and 2) Wilna; (3) Station, Wilna; (4) The gates of Great Synagogue, Wilna; (5) Courtyard of Great Synagogue, Wilna; (9) Commercial school, Wilna; (7-9) Minsk; (10) Jewish market, Minsk; (11) Fish market, Minsk; (12) The prison, Minsk; (13 and 14) Beresino; (15) Jewish sabbath, Beresino; (16 and 17) Smolowitzi; (18) Jewish children, Smolowitzi; (19) The old market, Warsaw; (20) Leszno; (21) Krakowski Predmjeste; (22) Nalewki; (23) Approach to Praga bridge, Warsaw; (24) Rumarska; (25-27) Nicolaieff; (28-30) Odessa; (31 and 32) Jewish soup-kitchen, Odessa; (33) Reservists, Odessa; (34) Kischeneff; (35 and 36) Ruins of Kalarasch after Pogrom, November 5, 1905; (37-40) Sebastopol; (41) Road travelling in Russia; (42) Intermediate railway station in Poland.—Rumania:—(43-45) Podul-Iloiae; (46) The station, Podul-Iloise; (47 and 48) Negresht.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

BAHR EL GHAZAL.
Percival.

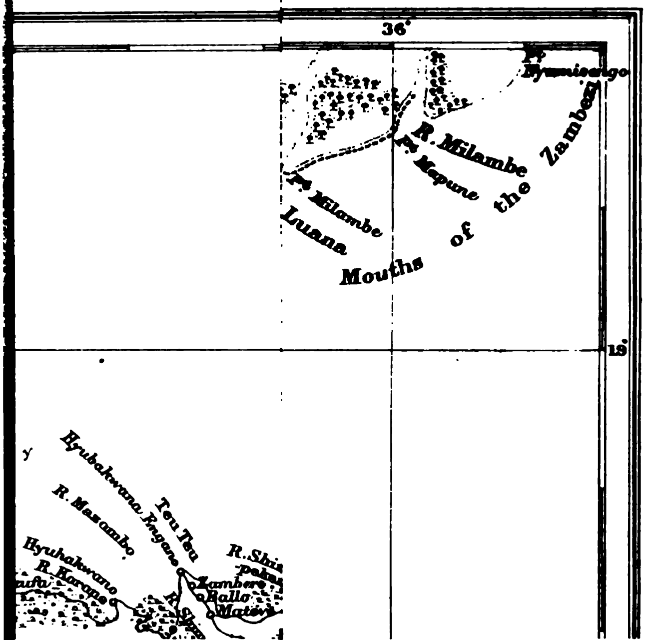
THE GEOGRAPHICAL JOURNAL, 1907.



TUGUESE EAST AFRICA.

USSEGLIO.

THE GEOGRAPHICAL JOURNAL 1907.



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